THE
ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER
ESTABLISHED 1872

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THE
ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXVI. No. 3252 MARCH 22, 1940 Price SIXPENCE

E.D.A. in Wartime

Reasons for Continued Support

THE need for the conservation of money and materials for war and export purposes has put the home market into a very uncertain position. And so far as the electrical industry is concerned that position has not been improved by the conclusion of the "truce" between gas and electricity suppliers.

In these circumstances the situation of a body set up primarily to conduct propaganda designed to expand the home market for electricity and electrical equipment becomes very difficult. With its principal activity shelved it has to look around to find useful work to justify its existence during wartime. As we have said before, there can be no suggestion that the British Electrical Development Association should remain in a state of suspended animation for an indefinite period. It must be kept going so that it may recommence with renewed vigour the work which the war has forced it to abandon.

Justifiable Activities

There are certain important matters, however, to which attention can justifiably be given in wartime. In fact, they can be considered as potent factors in prosecuting the war. First comes rural electrification. Anything which will help to increase food production must be pushed forward with all possible dispatch, and electricity can claim to be a means of speeding up production, increasing efficiency and saving labour in all branches of farming. One of E.D.A.'s biggest efforts in this direction was the staging of a complete electric farm at the Windsor Royal Show last year, and since then it has been hard at work intensifying its rural electrification activities. The Windsor display attracted the attention of 50,000 people, very largely of the farming community, and all the lighting, heating and cooking services of the Show were electric.

Battery vehicles may also be considered very desirable substitutes for petrol vehicles to-day for all forms of transport involving short distances with many stops—mainly delivery work. Consequently the Electric Vehicle Association, which is part of the E.D.A. organisation, has assumed considerably greater importance since September. The replacement of petrol by electricity makes possible a tremendous saving of imported fuel urgently required for military purposes. Moreover, the charging of vehicle batteries, mainly carried out during the night, provides a useful off-peak load to electricity supply authorities, justifying special rates.

A third direction in which active development is permissible is the reception areas under the Government and private evacuation schemes. Many districts have had to take in large numbers of people without being given time to make proper provision for their needs. Heating, cooking, water heating and lighting arrangements have proved inadequate in a large number of cases. The provision of these necessities has opened up considerable possibilities for the electricity supply industry in the affected areas. The electrical industry as a whole should seek thus to redress the balance upset by the loss of business in the evacuated areas.

The foregoing will be considered "legitimate" activities by the authorities; but is all ordinary development to cease? The modern home relies for its cooking, heating and water heating services very largely upon electricity or gas. During the past few years the coal fire has gradually been pushed further and further out of the picture for very good reasons. There is a strong case for its supersession in wartime when it is necessary to reduce raw coal consumption and the transport which it entails.

Gas-Electric Competition

It is when we come to the replacement medium that the electricity *versus* gas controversy arises. A "truce" has been arranged to eliminate uneconomic competition between the two industries. Who is to be the arbiter and what guiding rules are to be adopted when definition is attempted? Without questioning the need for a considerable reduction in opposing propaganda there are some who wonder whether it is not the gas industry which stands to gain most from a truce. After all, it is electricity which has made the pace in the past and has naturally encroached upon what were considered gas preserves. With its century or so behind it the gas industry is more likely to be carried along by its own momentum than the comparatively young electrical industry, for all its undoubted attractions.

The terms of the "truce" are set out on another page of this issue. It was apparently suggested to the parties by the Secretary for Mines when repre-

sentations were made against the Fuel and Lighting Order. The basis is somewhat nebulous, for it is agreed that "both industries would be making the greatest possible mistake were they to allow any understanding to have the effect of withdrawing either industry from every proper activity consistent with the present circumstances." What activity can be considered proper and who is to decide? New business is not affected, but the parties have agreed not to attempt to seduce consumers from their present allegiance, or to disparage one another's products. The interpretation of the terms of the truce would seem to rest finally with the local undertakings. It appears to us that E.D.A. might be able to advise these undertakings just how far they can go and assist them in going that far. But apart from this there is still plenty for E.D.A. to do in the way of advice to members, providing lectures, continuing its salesmanship courses and carrying on "prestige" advertising in addition to its electric vehicle and rural electrification work. It is therefore incumbent upon all supply authorities to continue their support, and it certainly seems as though they realise this.

E.D.A. and the Joint Committee

SPEAKING at the E.D.A. annual meeting, Mr. Nichols Moore said the Association wanted a liaison with the Joint Gas and Electricity Committee so that it would know what to do. This suggests that E.D.A. had no voice in the discussions which led to the formation of the Committee. It would have been thought that E.D.A. would have been called in at the very earliest stage for, after all, it is in possession of facts and figures which have a considerable bearing upon the question of rationing. When it comes to the modification of advertising matter the Association should certainly know where it stands. It does not seem to be quite the thing that it should have to submit its matter to a kind of censorship by the Joint Committee which will decide whether it infringes the rules by casting open or covert aspersions upon gas.

"Middlemen"

IN the course of a debate in the House of Commons last week, Mr. Herbert Morrison drew attention to the activities of certain people who endeavoured to secure commissions from manufacturers on the ground that they were able to influence the placing of orders by the Ministry of Supply. Mr. Morrison mentioned the name of an electrical concern which had been approached by some of these "middlemen." It has already been made clear, and was again stressed by the Minister (Mr. Burgin) that it is entirely unnecessary for firms to have recourse to intermediaries in their dealings with the Ministry. All negotiations can be carried out directly between the Ministry's officers and the firms desiring to tender for contracts.

Restriking Voltage

As a result of the work carried out at the switchgear testing stations definite rupturing capacities can be assigned to oil circuit-breakers that are close enough for any practical purpose. This does not by any means constitute the only value of these stations, however, and the investigations being made in them (see, for instance, Trencham and Wilkinson, *I.E.E. Journal*, May, 1937) are essential to further development, possibly in the direction of ultimately eliminating oil for arc extinction. One of the fundamental problems is the effect of the rate of rise of restriking voltage on circuit-breaker performance in all circumstances. The further studies of this aspect anticipated in B.S.S. 116, 1937, are typified by the E.R.A. paper which Mr. L. Gosland contributes to the current *I.E.E. Journal*. The question of how circuit characteristics affect performance is discussed in this issue by Mr. C. J. O. Garrard, who shows that the response of the circuit-breaker (inherent in its design) to the reactance-capacity ratio of the local distribution network should be taken into account. This has to be related to the need to restore the dielectric strength of the gap between contacts more rapidly than the restriking voltage introduces its stresses. Such considerations are at the bottom of the controversy as to whether test conditions are accurately reproduced in service and explains such points as the frequently adverse effects of reactors in the neighbourhood of switchgear.

Standard Cables

IN order to facilitate the manufacture during the war of flexible cables for connecting machines at the coal face, the number of types is to be restricted to eight, which will be supplied only in certain lengths. M.D. Circular No. 129 and Statutory Rules and Orders, 1940, No. 293 give general authority for the use of earth conductors of less than 0.022 sq. in. in 125-V cables for drilling machines under specirarely due to faults in cables themselves and, as the earthing conductor in 650-V pliable armoured cables again subject to compliance with defined requirements. Standardisation of cable sizes need not, however, be confined to the mines. For many years we have advocated it in the interests of cheaper distribution on public supply systems. As a war measure its advantages would be more obvious still, and they would remain with us afterwards.

Resistance to Fire

ALTHOUGH most electrical fires start with insulation failure, it does not follow that the best means of preventing them is to provide very high insulation values. The highest heat-resisting qualities in a cable dielectric would appear to be incompatible with the greatest number of megohms per mile and some compromise is called for. Also, it is difficult to reconcile non-inflammability with the prevention of ingress of moisture and the elimination of corrosion. Fires are rarely due to faults in cables themselves and, as the tests described by Mr. S. W. Melsom to the I.E.E. Transmission Section last week showed, the risk of their being extended by burning insulation is inconsiderable if suitable precautions are adopted. The shielding of straight lengths of exposed cable by split tubes of moulded asbestos should provide adequate enough protection, but the decrease in the current rating of the cables due to the thermal resistivity of the material is a drawback. If only for that reason, development in large conductor sizes of the new fire-resisting cable described (which is now available only for installation wiring) and for higher voltages would be a boon in especially hazardous situations.

Only a Shilling

MANY electricity undertakings, after delaying increasing their charges until the last moment, are now faced with the necessity of falling into line with the general trend. One of these is Gravesend, which up to the present has been able to maintain a farthing "unit" charge in the summer under the domestic rate. Various revisions proposed are said to be entirely due to the increased cost of coal, the higher cost of materials and wages being met by economies within the undertaking. Again, at Gillingham, where prices are also being raised, it is explained that "the increase in the price of coal from 22s. 6d. to 31s. per ton for the calendar year 1940 means an increase in expenditure of £6,800 and is mainly instrumental in bringing about the estimated deficiency of £6,422. In view of these facts it is difficult to comprehend the statement issued by the South Yorkshire Coalowners last week. Referring to "repeated assertions of electricity undertakings that their costs have been largely increased since the outbreak of war as a result of advances in the price of coal," they say that "the coal mining industry must point out that any increase in their production costs on account of higher prices for coal is absolutely negligible. The only increase authorised by the Government is the shilling per ton advance made in November, 1939." But there is no doubt that undertakings are paying much more than this, to whom is the money going?

TUBE RAILWAY PROTECTION

A Description of the Electrically Operated Floodgates Safeguarding the London Underground Railways

BY the courtesy of the London Passenger Transport Board, we were recently able to see three types of electrically operated floodgates which have so far been installed in the tunnels and stations of the London Underground Railway system in connection with the vast programme of emergency works which the Board has undertaken in conjunction with the Ministry of Transport.

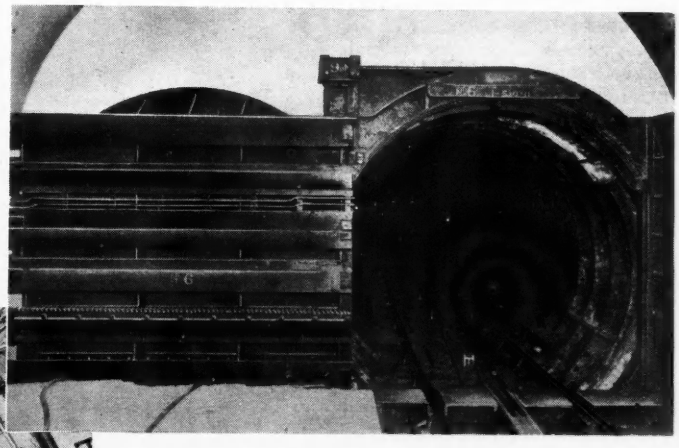
The main problem was to protect the railways from any possible risk of flooding, either from the River Thames or from sewers and water mains where these are in close proximity to the stations. This involved means for sealing off sections of the tunnels, either by horizontally sliding gates or hinged flap gates, according to the character of the tunnels, and sealing up passenger entrances to the platform tunnels, at points where these might be flooded, by means of drop-sector gates.

The horizontal sliding gates are steel units, each weighing six tons, which slide across the running tunnel and are located either at the platform head wall, or in a specially constructed chamber in the running tunnel adjacent to the station. Each gate is opened and closed by a 4-HP motor through reduction gearing, the final drive being taken via a pinion on to a rack mounted on the gate itself. The motor speed is 920 RPM, and the overall speed reduction is 130 to 1, giving the gate a full speed of 12.25 ft. per minute.

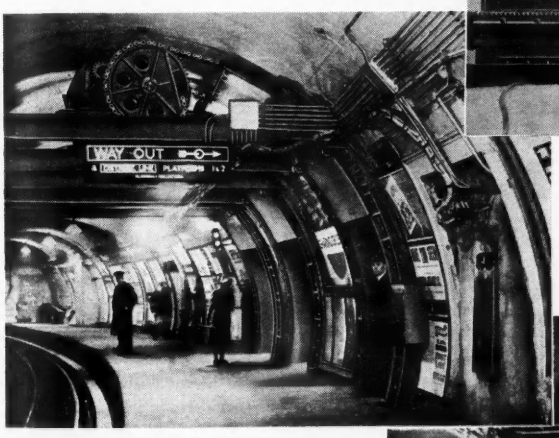
A duplicate power supply is provided for each gate, one from the Board's 33⅓-cycle mains at 440 or 220 V, and the other from the 50-cycle system of the local supply authority at 400 V. The motor is a three-phase, squirrel-cage unit with two separate sets of windings for use, respectively, on the two different power supplies, and arranged so that the same speed is obtained from each supply. In a special motor provided as spare to all the gates of this type, the 33⅓-cycle winding is arranged for operation at either 440 V or 220 V, according to the supply conditions at the particular gate for which the motor is required.

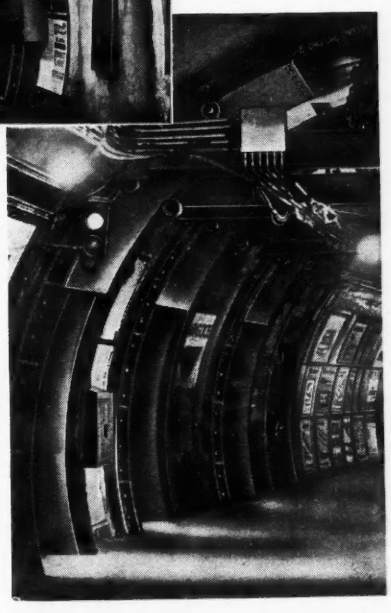
The controllers contain a straightforward automatic star-delta starter for controlling the motor, together with an auto-transformer arranged to supply a fixed voltage to operate the auxiliary circuits of the starter, whatever the power supply on which the motors are operated. The motor is started by pressing a start-button which puts the star-delta starter into operation, while limit switches, which are operated by the gate itself, stop the motor and apply the brake at the appropriate point when the gate is either fully opened or closed. A stop-button is also provided by which the gate can be checked at any point of its travel in either direction. These limit switches are specially arranged so that the operating spring is in compression to reduce the possibility of failure to the minimum.

The auto-transformer also supplies DC through a metal rectifier to operate a solenoid brake coil which works on a drum integral with the gearing serving to check the gate and hold it at each end of its travel.



The horizontal gates slide right across the running tunnel and are located at the platform head wall





The 3-HP motor of each drop-sector gate drives the gate-lifting gear through two sets of reduction gearing; total ratio 736 to 1. Right: The drop-sector gates slide in vertical curved guides

The coil is energised through a d.p. relay across the poles of which there is a discharge resistance. The brake solenoids are of the DC crane-rated shunt-wound type and are capable of a pull of 45 lb., including the 10-lb. weight of the plunger, through a 2-in. stroke operating on a voltage of 200; they are also capable of lifting 43 lb. gross when the voltage is reduced to 175. The controller, in addition, contains a multi-point change-over switch which is operated to connect either of the two supplies to the controller, and at the same time to make the appropriate connections to the motor windings and to the auto-transformer; it can also be padlocked in a neutral position to avoid interference. A hand-operated reversing switch is also fitted.

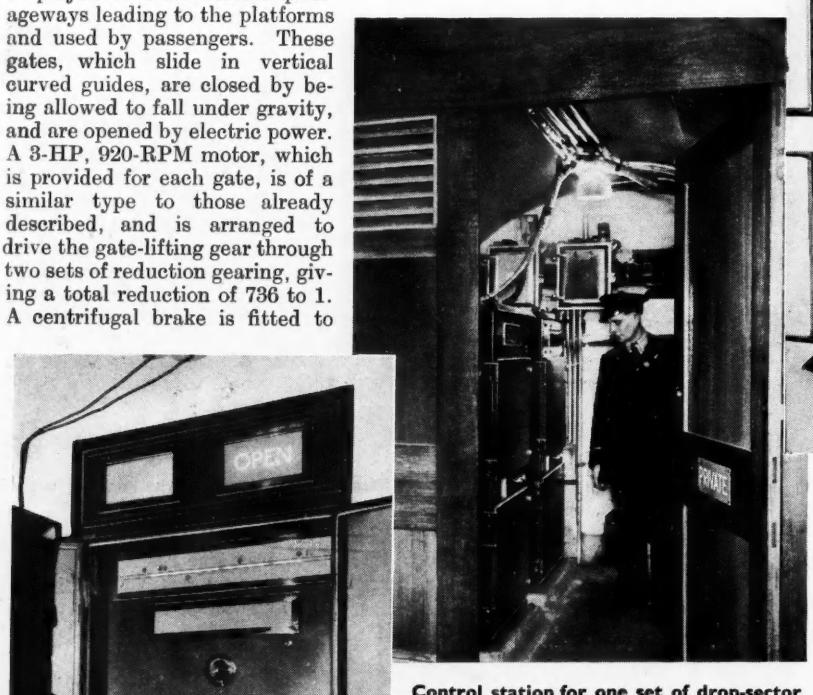
In the event of a failure of both power supplies, the gate can be opened or closed by hand. A clutch is provided to disconnect the motor from the gearing and a winding handle can then be attached, the brake being held off by means of a release handle. The

actual time of opening or closing the gate from switching on the motor is one minute. By hand operation the time is 4½ minutes.

The gate is locked in the open position, the lock being operated in conjunction with the signalling system and also interlocked with the gate controller. In the positions where trains approach the gate from the platform side, the release of the lock by hand automatically puts the platform starting signal to danger, and where trains approach the gate from the running tunnel side, the lock cannot be released so long as there is a train in that section of the running tunnel. Until the lock has been released it is not possible to operate the controller, but to guard against failure of the interlock contacts a push-button is provided on the controller to short-circuit this interlock and thus enable the gate to be closed electrically. This push-button is located behind a "Cellophane" shield. Closing the gate completely seals the tunnel mouth at the point where the gate is installed, except for the points at which the running rails pass through the horizontal sill upon which the gate runs. Sealing at this point is effected by means of specially shaped rail seals with rubber inserts, which can be quickly placed in position by hand before the gate closing operation commences.

Drop-sector Gates

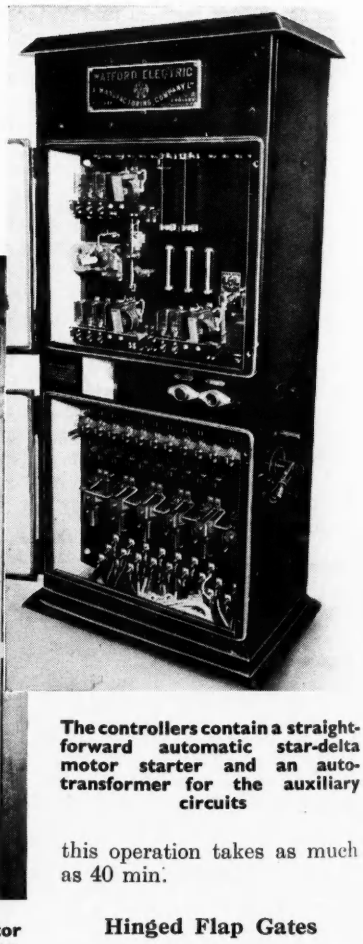
The drop-sector gates, each weighing 4½ tons, are employed to close certain passageways leading to the platforms and used by passengers. These gates, which slide in vertical curved guides, are closed by being allowed to fall under gravity, and are opened by electric power. A 3-HP, 920-RPM motor, which is provided for each gate, is of a similar type to those already described, and is arranged to drive the gate-lifting gear through two sets of reduction gearing, giving a total reduction of 736 to 1. A centrifugal brake is fitted to limit the speed at which the gate closes, and an AC operated clasp brake is provided to check and hold the gate in any position. These AC brakes are of the 10-in., three-phase type, the coils being suitable for operation on either a 400-V, 50-cycle, 3-phase supply, or at 220 V, 33⅓ cycles, three-phase.



Control station for one set of drop-sector gates. Left: Instructions to close gates are communicated to the operators by illuminated indicators operated by the traffic controller

The controllers are similar to those provided for the horizontal gates, but the reversing switch and rectifier are omitted. The three-phase brake coils are operated directly through triple-pole relays. The two power supplies are available for opening the gates, and they are closed from the platform side by releasing the clasp brake by means of a hand lever fitted close to each gate. Mechanical safety catches are provided on the gate guides, and these must be released before any attempt is made to close the gates.

Three sector gates are provided to close the entrances to a platform, and in order that the operator may take up a position in the passageway leading to the upper station after all the gates have been closed, one gate is arranged so that the brake can be released electrically by means of a push-button in the passageway, and this gate is closed last of all. In the event of the electricity supply failing, this gate must be closed by hand from the platform, and the operator then obtains access to the passageway by means of hand-operated watertight escape hatches in the tunnel wall. Closing of the gates takes 2½ minutes from the release of the brake, while opening electrically takes 3 min. In the event of supply failure the gate can be opened by means of a hand wheel which can be attached to the gearing, but this operation takes as much as 40 min.



The controllers contain a straightforward automatic star-delta motor starter and an autotransformer for the auxiliary circuits

Hinged Flap Gates

The hinged flap gates, which weigh 10½ tons each, are used where it is necessary to seal a double-track tunnel on surface lines. They are arranged to close under gravity and to be opened by electric power. Each takes the form of a flap, hinged at the tunnel roof, which is normally held in the open position above the track by means of two hooks on which the free edge rests. The operation of closing consists in raising the gates slightly off the hooks, withdrawing the hooks by means of a hand lever and allowing the gate to fall to its closed position under the control of a centrifugal brake.

Opening or lifting the gate is effected by means of ropes which pass round a series of pulleys and are connected to a rope drum driven through gearing by a 6-HP motor of a similar type to those already referred to in connection with the other types of gates. The motor opens the gate by raising it to a position in which the free edge is just clear of the retaining hooks. In this position movement of the gate is automatically

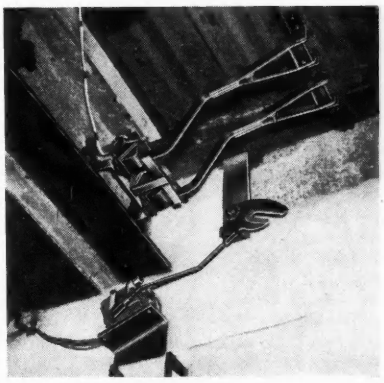
checked by means of limit switches operating in conjunction with the motor controller. The hooks are then swung into position again by hand and the gate is lowered on to them by gravity. Control of the gate during the operation of closing is effected by the centrifugal brake on the motor shaft already mentioned, and, in addition, a hand-operated clasp brake is available for checking and holding the gate in any position. The brake drum is connected to the gearing through a ratchet device, so that it is unnecessary to release the brake when the gearing is being operated for raising the gate.

In the interests of interchangeability the electrical control of the gate motor is effected by a control unit similar to those already described, but in this case there is no reversing switch, or brake-operating relays. The closing operation is carried out in 2¾ min. from the release of the brake, and hoisting under electric power requires 3¼ min. In the event of failure of both power supplies the gate can be opened manually by means of a hand-wheel attached to an intermediate shaft in the gearing. The end of this shaft is protected by a cover interlocked with the controller, so as to prevent the motor from being operated with the hand-wheel in position. For safety the retaining hooks are interlocked with the signal circuits and cannot be withdrawn to allow the gate to drop unless trains approaching the gates are protected by the signals being set to danger. When opening, the fact that the gate has been raised high enough to clear the track loading gauge is also detected by the signal circuits. Closing the gate seals the tunnel completely, except at the points where the running rails pass through the sills, and in consequence these are closed by means of rail seals placed in position by hand as in the case of the horizontal sliding gates. In the case of both the horizontal sliding gates and the hinged flap gates the joint between the face of the gate and the tunnel mouth is sealed automatically by hydraulic pressure acting on a specially shaped strip of "Linotex" rubber fitted round the internal periphery of the tunnel.

Operators are in constant attendance at the gates, and instructions to close the gates are communicated to them by illuminated indicators operated by the traffic controller. Receipt of the controller's signal is acknowledged by the operator by means of a push-button near his post. The operator is also in telephonic communication with the controller and, when necessary, with operators on adjacent sections of the track.

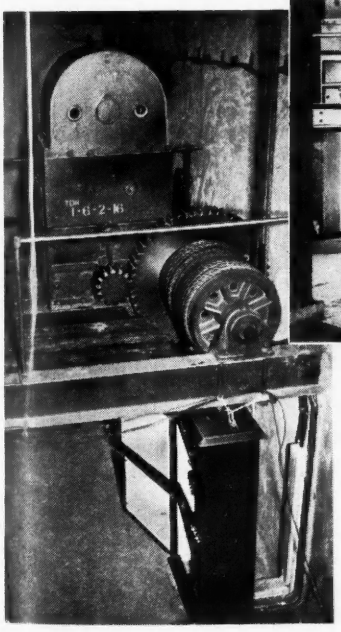
A fourth type of gate which is in course of installation consists of a vertical sliding gate attached to a counter-balance weight and arranged to seal a single track tunnel mouth. This is raised and lowered electrically.

All the gates themselves were made by Glenfield and Kennedy, Ltd. The motors, which are all of the high-torque, totally enclosed, half-hour rating, squirrel-cage type, were supplied by Lancashire Dynamo and Crypto, Ltd. The controllers, incorporating Westinghouse metal rectifiers, were supplied by the Watford Electric & Manufacturing Co., Ltd., the DC brake solenoids by the British Thomson-Houston Co., Ltd., the AC brakes by Elliston, Evans & Jackson, Ltd., and the limit switches by George Ellison, Ltd. The gates were designed by Mr. W. T. Halcrow, M.Inst.C.E., Consulting Engineer to the Transport Board, in co-operation with Mr. V. A. M. Robertson, M.Inst.C.E., Chief Engineer.



When the free edge is just clear of the retaining hooks movement of the gate is automatically checked by limit switches

We are indebted to the London Passenger Transport Board for permission to view the gates and to take the accompanying photographs, and to the engineering department for help in the collection of the information regarding the equipment embodied in this article.



The 10½ ton flap gates are hinged at the tunnel roof and seal a double-track tunnel on surface lines; note control gear on left. Opening the flap gate is effected by a rope drum driven through gearing by a 6-H.P. motor; motor control panel at bottom

Transport Congress

ARRANGEMENTS have been made for the annual congress of the Public Service Transport Association to take place in London with headquarters at the Hotel Victoria. On May 1st there will be an informal evening reception by Col. Sir Joseph Nall, M.P., chairman of the Council. On May 2nd, after the annual general meeting, a paper by Mr. Ben England (general manager, Nottingham City Transport Department) describing "Ways and Means in Wartime" will be discussed. The Association's luncheon will follow. On May 3rd various aspects of passenger transport will form the subject of a discussion.

CIRCUIT BREAKING

Further Knowledge Needed

By C. J. O. Garrard, M.Sc., A.M.I.E.E.

Anticipating that the construction of networks operating at voltages in the region of 500 kV will come under consideration within a decade or two, the author states that the design of economical and efficient circuit-breakers for such voltages will demand an extension of our knowledge of circuit severity

IN the foreword to the revised British Standard Specification for oil circuit-breakers (B.S.S. No. 116/1937), it was stated:—During the preparation of these Specification it has been found that before all the conditions can be laid down with certainty a large amount of research work is necessary, particularly on the making-capacity and breaking-capacity of oil circuit-breakers of large sizes . . . In due course it is anticipated that further additions to the Specification will be made, based, for example, on further investigations upon the short-circuit performance of circuit-breakers, and on the numerical values of the rate-of-rise of restriking voltage which is likely to exist at typical points on a supply network and their influence upon the selection of a suitably rated circuit-breaker."

In considering this statement in the light of subsequent experience, three questions arise: (a) How far has B.S.S. 116/1937 fallen short of what would have been desirable in respect of the precision with which it defines the conditions of service and testing? (b) What gaps still remain in our knowledge of the conditions which govern the severity of the duty of circuit-breakers in networks and in testing stations? (c) Are these gaps of great practical importance and if so in what circumstances? So far as oil circuit-breakers are concerned the Specification has met the requirements both of users and of manufacturers to a truly remarkable degree. The only additions or alterations which it is necessary to envisage are those required to extend the scope of the Specification to apparatus which it was not intended to cover by the original edition, such as low and medium voltage circuit-breakers.

The problem of circuit severity in relation to the operation of circuit-breakers may be considered to have two aspects. There are first such factors as the system voltage, the recovery voltage, the value of current, the power factor and the connections of the test circuit, all of which are adequately covered by the Specification. Second, there are matters such as the natural frequency of the circuit, the rate-of-rise of restriking voltage and so on. The main difference between the two groups is in the order of magnitude of their time bases. In the former case the intervals are of the order of 10^{-2} sec., in the latter of 10^{-4} to 10^{-6} sec.

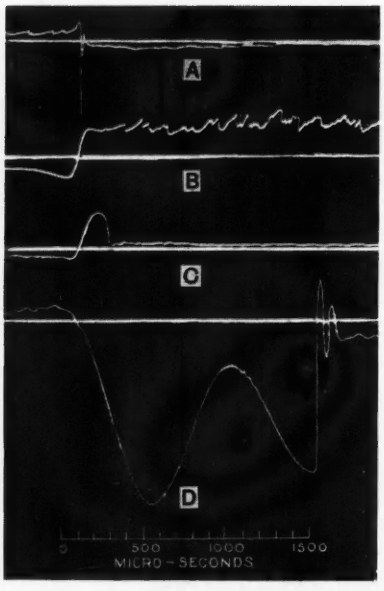


Fig. 1

Questions of the first group may be considered to be solved at the present time; it is, of course, possible that new ones may arise, but it is not easy to see what they could be. The position as regards the second is not much clearer than it was two years ago. The foreword to B.S.S. 116/1937 mentioned as the main problem the measurement of the rate of rise of restriking voltage in networks. In the meantime much information upon this point has been collected. On the other hand, however, it has become doubtful whether the rate of rise of restriking voltage alone is the parameter governing circuit severity. In fact, the problem at the moment is not so much one of measuring values of the parameters governing circuit severity and of comparing the parameters of different networks with those of testing stations, as of determining what these parameters are. Thirdly, it may be asked whether the trouble and expense of pursuing further research is desirable or necessary, and whether any great advantage is likely to be attained by a definition of operating conditions more precise than that given by B.S.S. 116/1937.

As far as oil circuit-breakers are concerned, and as long as one confines oneself to present limits of voltage and breaking capacity, it seems unlikely that research into the finer points of circuit breaking will result in any appreciable economy in their use. Construction and rating are subject to so many requirements other than mere ability to break the circuit under given conditions that any great economy by means of improvements in arc-control devices seems unlikely. The same applies to methods of calculating the severity of the duty at any point in a network. This statement is made with caution and under the reservations mentioned below. It is, however, in the author's view, important that the fact of continued research into the scientific basis of the circuit-breaker specification should not give the impression that the existing specification is ill-founded or likely to be radically altered in a short time. This, one may be reasonably certain, is not the case.

The statement applies, however, only to circuit-breakers in which oil is the extinguishing medium. Where a blast of air is used, which is the only practical alternative, a more exact definition of circuit severity than is at present available becomes necessary.

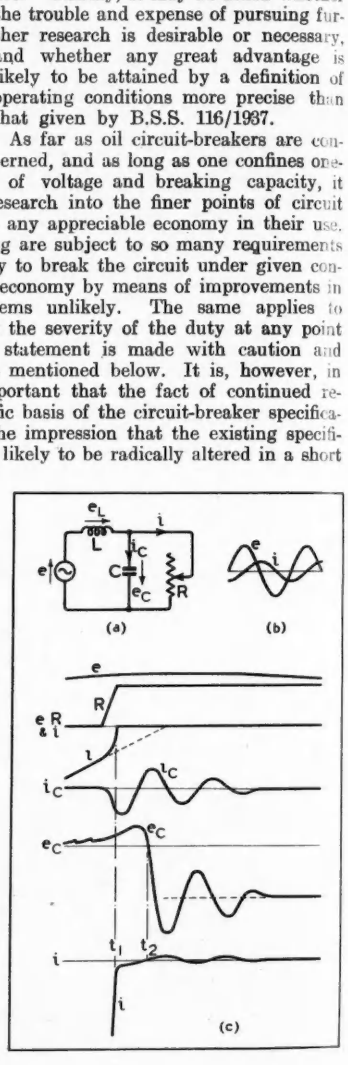


Fig. 2

Owing to the ease and rapidity with which arcs burning in hydrogen (oil vapour) may be deionised, oil circuit-breakers are little affected by variations of the inherent restriking transient of the system within the limits usually encountered.

Arcs in nitrogen (air) deionise from thirty to fifty times more slowly than in hydrogen, so that variations of the form of the restriking transient within the normal limits have a marked effect upon the operation of air-blast circuit-breakers, even when special means are adopted to reduce their susceptibility. It is, therefore, important that research into circuit-breaker performance should be continued so that a rational basis for the rating of these new types of breaker may be found.

The construction of networks operating at voltages of the order of 500 kV will probably come under consideration within a decade or two. The design of economical and efficient circuit-breakers for such voltages will demand an extension of our present knowledge of circuit severity.

All high-power AC circuit-breakers break the circuit near the natural current zero, so that in order to define circuit severity we must understand why the arc does or does not restrike at this instant. Much work has been done in studying restriking voltage transients which follow successful extinction of the arc, and the parameters which fix their shape are fairly well understood. Less notice seems to have been taken of the transient phenomena during the restriking of

the arc although these are of great interest and variety. Some typical examples are shown in fig. 1.

In fig. 1A the arc voltage before current zero is high; the current is forced down rapidly by the increasing arc resistance, a high peak of restriking voltage is built up and the gap breaks down again almost at once before the peak voltage is reached. The whole matter occupies about 20 micro-sec.

In fig. 1B the arc resistance remains low and damps the circuit so that no peaks of voltage appear. The current approaches zero at the normal rate, the arc is extinguished but restrikes immediately in the reverse sense and the arc voltage swings over smoothly to its new value. The process lasts about 100 micro-sec.

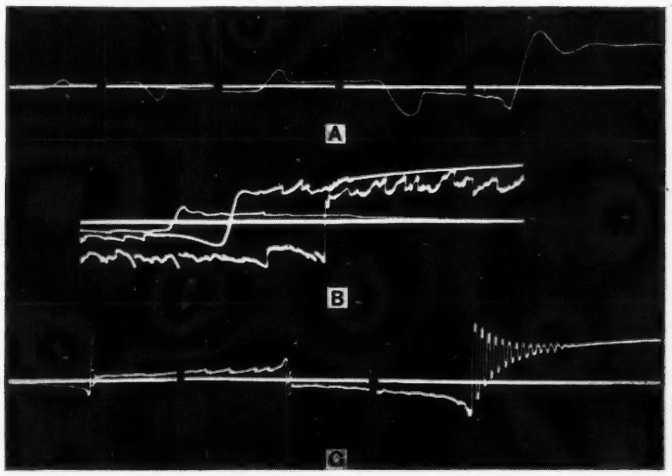


Fig. 3

In fig. 1C the arc voltage is moderately high, notwithstanding which the current persists until very nearly its natural zero point; the restriking voltage transient is damped, and the voltage swings slowly towards the peak value of the recovery voltage. After a long time the resistance of the gap begins to decrease, the residual current increases and the gap returns slowly into its previous highly conducting condition. The process lasts about 200 micro-sec., or roughly ten times as long as that in fig. 1A.

Fig. 1D shows an uncommon but interesting type of transient which develops as a lightly damped oscillation. After about 1,500 micro-sec., when the breaker has withstood the peak of the restriking voltage, the gap suddenly collapses with the same speed as in fig. 1A.

Consider now a breaker (represented by a variable resistance R) in a circuit containing inductance and capacity (fig. 2a). The current (i) which lags 90 deg. on the voltage (e) is negative and approaches zero* (fig. 2b). The time scale is very extended, so that the system voltage is nearly constant over the interval in question (fig. 2c).

The action of the breaker corresponds to a very rapid increase of R near the current zero. During this time we have (neglecting C for the moment):

$$e = iR + L\frac{di}{dt}, \text{ or } \frac{di}{dt} = \frac{e}{L} - \frac{iR}{L}$$

As i is negative, one sees that the effect of R is to increase the rate at which i falls to zero. R is, however, not a constant, but increases as i decreases and as the cooling increases. It may be shown that if the rate of increase of R with respect to a decrease of i is large, the circuit becomes unstable at a low value of i, and i decreases extremely rapidly.

The current, which cannot flow through the breaker because of the increase of R, is forced by L to flow into the condenser C until this is charged to a voltage equal and opposite to the back EMF induced in L by the rapid increase of i.

The condenser voltage e_C, which is also the voltage across R, therefore increases above its original value which was equal to the arc voltage. When C is fully charged it begins to discharge, e_C decreases, reverses its polarity and rises towards e. Due to the effect of L it overshoots, C again discharges, and so on. The well-known restriking-voltage transient results, represented by e_C and i_C.

Consider the current i, which is drawn on a large scale at the bottom of fig. 2c. At t_1 it falls rapidly to a very small value. There are two alternatives: If the cathode spot is maintained after t_1 an appreciable current must flow; that is to say, R must be low enough to affect the damping of the oscillatory circuit. If the cathode spot is not maintained, the current must fall to a very low value indeed, corresponding to a glow discharge. In either case, however, the polarity of the gap is fixed by the charge of C and i cannot reverse until t_2, when the process of charging and discharging C is complete. This period t_1 to t_2 must be of great importance, as during this time the voltage across the breaker is prevented from attaining a high value, and after a preliminary moderate increase must fall to zero within a short time.

By this means an interval is provided to ensure that the establishment of the dielectric value of the gap has a sufficient lead upon the appearance of the restriking voltage transient. The intensive cooling of the arc before current zero may therefore be just as important for the breaking process as the scavenging of the arc path after current zero; t_1 is the first critical point in the breaking process. The instant t_2 is the second.

If the cathode spot has disappeared from the positive contact before t_2 it is unlikely that it will reappear immediately upon the other contact when the gap-polarity reverses. Any subsequent breakdown of the gap will only take place when the restriking voltage has attained a sufficient value to form a glow discharge, which may subsequently develop into an arc in the well-known manner. This might result in a restriking transient such as fig. 1A or 1D.

If the cathode spot persists until t_2 there are again two alternatives: it may not reappear immediately upon the other contact if, for instance, this has been intensively cooled. In this case the process of subsequent breakdown will be as described above. It is certain that a breakdown of this type demands not only a minimum voltage gradient but also a minimum voltage-time interval for its completion (c.f. breakdown by voltage surges) even in the absence of any very active deionising or cooling process.

If on the other hand the cathode spot persists until t_2 it seems likely, having regard to the ease with which an arc is maintained under conditions of slight cooling, that in most cases the cathode spot is immediately re-formed and that a small but appreciable residual current continues to flow.

The circuit now endeavours to set up across the gap a voltage corresponding to the inherent restriking-voltage transient, while the residual current exerts a damping effect which increases as the resistance decreases.

The inherent rate of rise of restriking voltage of the circuit is proportional to $\frac{1}{2\pi\sqrt{LC}}$, whereas the degree to which a given value of R damps the oscillation depends upon the ratio $\sqrt{L/C}$. That is to say, the greater the product of L and C the greater is the inherent rate of rise; the greater the quotient L/C, the more is the oscillation damped by a given degree of conductivity in the gap between the contacts. On the other hand, the circuit is striving to build up the restriking-voltage transient and thus to force more and more current through the breaker. The greater this current the more is the transient damped, and at the same time the greater is the tendency for the resistance of the gap to decrease and for the current to increase indefinitely. On the other hand, the greater the current that the breaker can allow to pass without its gap-resistance beginning to fall, the greater is the possibility that the restriking transient will be damped out to a harmless form.

In place of the idea of a race between the restriking-voltage transient and the dielectric value of the gap, where the effect of any interaction between the two before the actual moment of breakdown is absent, we have that of a contest between the circuit and the breaker, in which the circuit endeavours to break down the resistance of the breaker by forcing current into it, while the breaker strives to build up the dielectric value of its gap at the same time as it is reducing the rate of rise of the restriking voltage by allowing the residual current to flow.

The circuit may be considered as being more or less "stiff" (the "stiffness" apparently being related to the ratio C/L), while the breaker may be "hard" or "soft" according to whether it resists the attack of the circuit by building up a high resistance, accepting little current and withstanding the resultant restriking voltage peak by virtue of a high dielectric value, or by accepting a large current, thus exhausting the restriking effort of the circuit and so to speak cushioning the blow. In general, the "stiffness" grows less as the natural fre-

(Concluded at foot of next page.)

** The convention for constructing fig. 2 is as follows: A current flowing in the same direction as the arrow is drawn above the line. A voltage is drawn above the line if the part of the circuit at the head of the arrow is positive with respect to the part at its tail.*

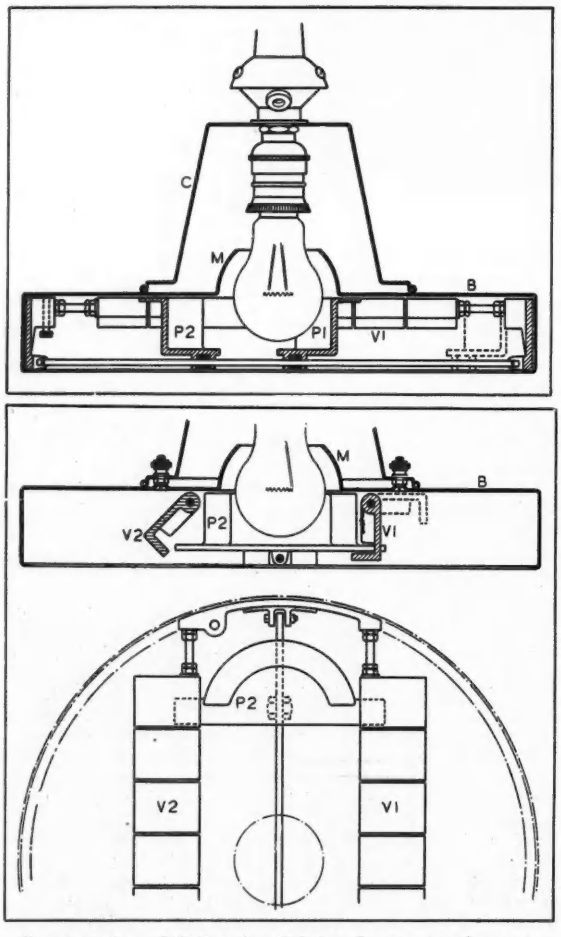
OUTSIDE LIGHTING IN PARIS

System of Control

THOUGH the street lighting intensity in Paris has been considerably reduced since the beginning of the war a degree of visibility is maintained without creating excessive halo. On receipt of an air-raid warning the lamps have to be extinguished immediately, the control system being, rather curiously, designed for semi-manual operation.

The lamps are connected individually to the general low-voltage distribution network and this has rather complicated control from a central point, since each standard must have a relay for lighting and another for extinction, each responsive to a predetermined audio frequency, between about 400 and 1,000 cycles, which can be superimposed on the 50-cycle feeders.

Each of the distribution sub-stations has a control installation for the standards fed off its network, including a special



Construction of fitting for lighting factory yards, etc.

small generator of variable frequency. The main element of the control board is a series of double jacks, each pair corresponding to a definite frequency, with a plug to connect the two jacks of any pair, thus automatically regulating the generator. Below the plugs is a switch to start up the generator, which runs until it reaches the frequency for which it is jack-regulated, when its output is automatically fed at fixed intervals into each feeder successively by automatic relays. When all feeders have received the impulses from the generator, the whole system automatically stops.

The automatic operation of the relay system is watched by the operator at his control board, each cut-over and each change of position of any of the automatic elements being signalled by a light. Sub-stations with outgoing feeders at 12 kV require 4 to 5 min. to operate all the street lights they supply, but stations with 3-kV feeders take up to about 8 min., the latter having a larger number of outgoing feeders to be operated. Three different ways of signalling the operator to light or extinguish street lamps are provided. First, by telephone; secondly, by a photo-electric cell system; and thirdly, by a time clock. A photo-electric cell is installed on the roof of each sub-station and when the general intensity of daylight falls or rises beyond predetermined levels, the cell operates relays, warning the operator that the lighting can be switched on or off. The time-clock provides the signals for the usual daily switching-on and extinction of street lighting, whereas the photo-electric cells are intended for occasional control when light falls below normal during the day.

For exterior illumination a lantern, specially designed to permit outside lighting to be continued in factory yards and other places where light is necessary, has been designed by the Eclairage Technique, of Nancy. It is intended to take a lamp up to about 200 W and to give an even low intensity. The light must not be allowed to fall on bright or vertical surfaces, such as a wall or building.

Enclosing the lamp is a hood (C) (see diagram) sufficiently large to permit dissipation of the heat without the need for ventilation holes. On to the lower edge of this hood a larger circular hood (B) is fixed by thumbscrews. Inside this, and surrounding the lamp, is a bright metal reflector (M) to diffuse the light evenly. The dimensions of the hoods and of the reflector are so calculated as to make the filament of the lamp lie in the same plane as the top of the hood (B), inside which is a series of four screens, arranged along the four sides of a rectangle. Two of these (V1 and V2), are merely hinged at their upper edge, and run almost the full width of the large hood. The other two slide on rods. The two former screens (V1 and V2) are of an L shape and divided into sections by ribbing, so as to absorb the maximum of the light which strikes them. They can be moved on their hinges to any desired angle. The other two screens (P1 and P2), comprise a flat lower plate and a semi-circular vertical part rising from it. They slide along a rod in the bottom of the larger hood (B) and can also be moved into any desired position so that the light falls only on the ground where it is needed, permitting any desired size and shape of light distribution to be calculated.

Circuit Breaking (*Concluded from previous page*)

quency increases, which may explain why an indefinite increase of natural frequency does not produce an indefinite increase in severity. The "stiffness" also decreases as L/C increases, so that, for instance, a breaker very near a current-limiting reactor, where the electrostatic capacity of the leads is small and the natural frequency of the circuit and the inherent rate of rise of restriking voltage high, may not be subjected to such severe duty as has hitherto been assumed.

In fig. 3 are given some typical oscillograms illustrating the foregoing remarks. In fig. 3A the breaker makes four unsuccessful and a final successful effort to break the circuit. The maximum rate of rise in V per micro-sec. in each attempt is: (1) 330, (2) 490, (3) 560, (4) 670, (5) 1,500. On the first four attempts the resistance of the gap remains small enough first to damp the oscillation very considerably, and finally to lead to the renewed breakdown of the gap. On the fifth attempt, while the resistance is still low enough to alter somewhat the shape of the transient, no instability results and the circuit is broken.

Fig. 3B shows a similar series of attempts, in which the rates of rise in V per micro-sec. are: (1) 45, (2) 105, (3) 375. Fig. 3C is a contrast to these two and shows the rate of rise practically constant in three attempts to break the circuit at a value of about 2,700 V per micro-sec. It appears that in this case the gap resistance is never low enough appreciably to alter the shape of the transient. It may be, therefore, that the cathode spot disappears as described above and the breakdown is of the form of a voltage flash-over.

The conclusion from this discussion is that no definition of circuit severity is possible that does not depend upon the characteristics of a particular type of circuit breaker. That is upon the degree of conductivity retained by the gap between the contacts, and upon the manner in which this conductivity influences and is influenced by the circuit. The same arrangement of C, L and R in the external circuit may give rise to different severities, according to the type of breaker in use.

The inherent rate of rise of restriking voltage (the rate of rise when the circuit-breaker has infinite resistance) may not therefore always define the true severity of the circuit, nor does it take account of the "stiffness" of the circuit. It is possible to have two circuits, each having the same current, voltage and natural frequency and yet with different degrees of stiffness as determined by the ratio L/C.

E.D.A.'s COMING-OF-AGE

Annual Luncheon and Meeting

THE annual luncheon, followed by the annual general meeting, of the British Electrical Development Association, was held at the Savoy Hotel, London, on Friday, March 15th. The chair was taken on both occasions by the Rt. Hon. the Earl of Lytton (President of the Association).

About 500 representatives of all sections of the industry assembled at the luncheon. Capt. the Rt. Hon. Euan Wallace, M.C., M.P. (Minister of Transport) was to have been the principal guest but owing to an attack of influenza he was unable to be present. His place was taken by Mr. Robert H. Bernays, M.P., his Parliamentary Secretary. A surprise was sprung upon those present, however, when Capt. Wallace spoke for a few moments from his bedside, his remarks being clearly heard through the loud speakers. He expressed his great regret that he was unable to be present at the coming-of-age party of the Association and added that electricity had come to his aid and enabled him to say a few words, although in a somewhat ghostly manner. He also said that he was to hear the speeches which were going to be made at the luncheon.

The President, speaking back to Captain Wallace, expressed the regret of everyone that he had been prevented from attending and hoped that he would have a speedy recovery from his illness.

Earlier, the President had reported the receipt of the following telegram from H.M. the King: "Please convey to the members of the British Electrical Development Association assembled to-day my sincere thanks for their loyal message, which I appreciate." He also said that telegrams of congratulation and good wishes had been received from the Prime Ministers of Canada, Australia, South Africa and New Zealand, and from the Edison Electric Institute, New York.

Mr. Robert H. Bernays, proposing "The British Electrical Development Association," said that to-day there was, of necessity, a re-orientation of the work of the electrical industry. This was not a war in which "business as usual" could be the slogan; everything must be subordinated to the winning of the war in the shortest possible time. Electricity was playing a vital part in our war effort. Not only was it of vital importance in the manufacture of munitions but also in agriculture, and more production of food at home meant less strain on our tonnage capacity for imported food. He was also glad the electrical industry was actively co-operating in the Government's Food Campaign, and he hoped that the cookery demonstrations which were given before the war would be continued. After urging the need for a better standard of lighting in the home instead of the reduced and depressing standard which was adopted in so many cases last September, Mr. Bernays advocated development of the electric vehicle.

The speaker said it had been suggested that about 100,000 vehicles in Great Britain now consuming petrol could be replaced by electrically driven vehicles. There was, he said, no intention of placing an embargo on all domestic or commercial development but there were two limiting considerations—the necessity for conserving our financial resources, and the need for keeping the industry's requirements for essential materials to a minimum. There was also the possibility that some form or degree of rationing of electricity might, at some stage, have to be introduced.

He regarded as a wise step the arrangement between the electricity and gas industries to apply a truce to competition for the duration of the war and concluded by remarking that when the guns ceased and the smoke had lifted, the expanding uses to which electricity could be put would have developed in the public mind to an extent and with a rapidity that hitherto we had hardly dreamed of.

The President responding to the toast, said this annual luncheon marked the coming-of-age of E.D.A., and normally a great deal would have been made of it. In present circum-

1. Mr. J. Mould. 2. Mr. H. C. Lamb. 3. Mr. A. J. Hutchinson. 4. Sir Archibald Page. 5. Sir James Devonshire. 6. Mr. A. E. McKenzie. 7. Mr. R. Birt. 8. Mr. Robert Bernays. 9. Lord Lytton. 10. Mr. E. Jones. 11. Mr. C. G. Morley New. 12. Bailie Gardner. 13. Mr. E. Seddon. 14. Mr. E. E. Hoadley. 15. Mr. F. W. Purse.

Among those present at the E.D.A. luncheon

stances, however, it seemed rather unreal to be talking of anything else than winning the war. It was opportune, nevertheless, to recall how the Association had been linked up with the general industrial conditions during the 21 years of its existence. Among the electricity supply undertakings before the Association was formed, there was very little concerted action but after the last war ended and E.D.A. was formed the industry generally began to revive and active development began to be marked. From that time it could be said that the development of electricity kept in step with the prosperity of Europe, and on the whole provided a fairly accurate barometer of trade. The number of houses connected to an electricity supply at the end of the last war was not greatly in excess of a million; an electric cooker was a rare luxury, broadcasting was unknown and the talking picture did not exist. At that period the number of units of electricity generated by the power stations of this country was about 3,000 million. To-day it was approaching 26,000 million. Again, nine million houses were to-day connected to the electric mains out of a total of twelve million, and 1½-million British housewives were cooking by electricity.

After a reference to the humble beginnings of E.D.A., and a tribute to its founders, the President spoke of the ramifications of the Association to-day with its advertising and editorial departments, its area organisations, exhibition section and staff of technical experts, lecture services, statistical department, film production department, assistance in showroom design and a department for the production of brochures, booklets, posters and a thousand and one other aids to modern propaganda.

He concluded by saying something about the part played by electricity in the war effort to-day. There was an immense development in the use of electricity in munition factories and the export of electrical machinery. He made reference to the manner in which lighting engineers had gone against all their natural instincts in devising means of creating less and less light, and to the appreciation of the work of electrical engineers by Sir John Anderson, Minister of Home Security, in this respect. There were many ways in which electricity was taking part in the defence of the country which could not be divulged until the war was over, but when that time came there would be much work for the industry to do in the general reorganisation which must follow. He assured the manufacturing and supply side of the industry that E.D.A. would be ready to play its part in telling the public what was being done and what more could be done for them.

Annual General Meeting

At the annual general meeting which immediately followed the luncheon the report and accounts for 1939 were unanimously adopted. Due to the suspension of certain activities in consequence of the war, there is a balance in hand of £17,641, whereas normally the expenditure is arranged to nearly balance the income. Owing to the large balance this year, questions of income tax and excess profits tax have arisen and these are being discussed with the Commissioners of Inland Revenue. The Council has decided to ask for only half the normal subscriptions during 1940.

Mr. Nichols Moore (Chairman of the Council) in presenting the report said it was fortunate that the greater part of the work outlined for 1939 had been carried out before the war came, and he specially mentioned the water heating and cooking campaigns. There had been 68,000 applications for the cookery book. He also mentioned the new Kitchen Planning Service.

Coming to the war period, he said it had been necessary for the Council to sit down and think and it was realised that for the time being it was not possible to go on with the scheme of national advertising which had been planned. Since then, however, a certain amount of prestige advertising had been carried on. Commenting on the agreement that had been come to, at the request of the Government, between the gas and electricity industries in assisting the National Food Campaign and for neither industry to attempt to make capital or seek commercial advantage to itself out of this assistance during the war, Mr. Nichols Moore said there had been complaints from the provinces that certain gas undertakings were not carrying out the spirit of that agreement. He did not think that was due to the national organisations of the gas industry but he was bound to say that if any part of the gas industry broke away from the agreement it must not be surprising if there was some reaction in the electrical industry, if the Ministry concerned could not control the position. The Director of E.D.A. had already made representations to the Minister on the matter.

Mr. A. J. Fippard, who moved the adoption of the report, referred to the fact that there were still some supply authorities which were not members of E.D.A., and expressed the hope that by the 21st annual general meeting the whole of the undertakings would have joined. It could not be that the subscription was too high because this year it would only be 1s. per £100 of revenue. If, therefore, these undertakings did not join because of dissatisfaction with the policy of the Council, it was to be hoped they would state exactly their objections so that the Council could deal with them.

Mr. H. C. Lamb (Manchester) remarked that whilst at the annual meetings of E.D.A. there was never any serious criticism of the Council's policy, outside one heard a good deal of criticism. He therefore challenged those who criticised outside to come forward and make those same criticisms at the annual meeting.

The remainder of the business of the meeting was of a formal character. Lord Lytton, having indicated his willingness to remain in office as President for a third year, was cordially thanked. In acknowledging the vote of thanks he said he had derived a great deal of benefit himself from being President in that it enabled him as chairman of a supply undertaking to get into touch with many branches of the industry which otherwise he could not have done.

Mr. Nichols Moore was also cordially thanked for his work as chairman during the past year, it being emphasised that he had had a particularly difficult period of office. In acknowledging the vote of thanks, Mr. Nichols Moore warned his successor—Mr. F. W. Purse—that he was likely to have a no less difficult time. Other votes of thanks included one to the Director (Mr. A. C. Cramb) and his staff.

Report and Accounts

It is stated in the report for 1939 that while the war has necessitated a reorientation of the Association's work it has not to any appreciable extent arrested its forward purpose. There was a net increase of one in the membership, making 419, and the income rose from £112,606 to £119,800, due to an increase in the amount of subscriptions.

The year opened auspiciously with the most successful sales management conference yet held and the Kitchen Planning Service came into operation. An effective water-heating campaign was succeeded by a cooking campaign in the course of which "Cooking with Confidence" was widely distributed. An ambitious lighting campaign planned for the autumn had to be cancelled, but it should be mentioned that since the close of the year the Association's useful book on factory lighting has been circulated to about 25,000 industrial concerns.

Mr. A. Nichols Moore, who presented the Council's report for the year

Much attention was given to rural electrical development during the year. A complete electric farm exhibit was arranged at the Windsor Royal Show and an illustrated booklet, "Electricity in the Countryside" was widely distributed. This is one aspect of development which assumes greater importance during wartime; another is the electric vehicle which can very often replace the petrol vehicle and thus conserve imported fuel. A nation-wide campaign was commenced and will be developed on a larger scale this year.

National advertising has had to be curtailed but "prestige" announcements are being inserted in the national Press and they have met with commendation throughout the electrical industry. Another activity which has been curtailed is exhibitions. Further films have been produced.

The Association's wartime service to members has included the prompt issue of emergency bulletins giving guidance on such matters as fuel rationing, war insurance, hire-purchase and other subjects. It has also provided liaison between the industry and the public by means of a series of Press conferences.

The domestic salesmanship courses continue to be successful; up to the end of the year 1,151 students had passed the final examination and gained the certificate, 41 with distinction. In addition 383 domestic salesmanship diplomas and 61 sales engineers' diplomas had been awarded.

Other activities mentioned in the report are street and playground lighting, space heating, commercial cooking, industrial heating, power development, electric traction, air-raid precautions, public speaking competition, lecture service and the Building Centre. The reports of the Area Committees demonstrate the advantages of this decentralisation of activities. Mention is also made of the work of the Electric Vehicle Association and the Electrical Association for Women.

INSTITUTION PROCEEDINGS

Electrical Mining Equipment. Possible Developments in Eire. Oil-engine Costs.

Electricity in Mines

UNDERGROUND uses of electricity in coal mines were dealt with in a paper by Mr. D. M. Rait which was read before the Association of Supervising Electrical Engineers in London on March 19th. Tabulated statistics showed how the uses of electric power were progressively increasing, that mechanical plant had not yet reached the saturation level and that compressed air still occupied an important place in the mechanisation of mines. Haulage and pumping accounted for the greater portion of power used, coalcutters being the next important consuming machines.

Telephones and signalling bells played very important parts, various ways of rendering them incapable of igniting gas being indicated. But intrinsic safety was not a sufficient safeguard, so that it was necessary to specify the type of battery to be used with them and the maximum permissible voltages and restricted currents. Certain constructional details of permissible types of power cables were also specified by the Mine Regulations, chiefly relating to metallic coverings and continuity of earthing.

Both oil-break and air-break switchgear were extensively used in mining work, generally tested and certified as flameproof. Besides the usual overcurrent and low-voltage trips an additional feature was core-balance earth-leakage protection, which was very necessary in mining work because leakage to earth must be arrested immediately to ensure that open sparking did not occur.

For face machinery attached to trailing cables further protective features were necessary, particularly when plug and socket might not be making perfect earth connection. One of the earliest ways of overcoming this risk was by "Williams-Rowley" protection, with a step-down transformer of 6 to 12 V energising a hold coil through a pilot core in the trailing cable, the return circuit being the earthing core. Thus if the earth connection were poor or of high resistance the low voltage would be insufficient to energise the hold coil, the controlling switch having a free handle.

For coal-cutting machines and certain types of face conveyors lack of space necessitated remotely controlled air-break contactor gear installed in the gate (the road leading to the coal face) with a push-button or equivalent switch within reach of the operator on the machine, together with a reversing switch, where necessary, not called upon to make or break circuit on load. Both the pilot and earth cores which conveyed low voltage to the contactors were respectively protected for continuity and against becoming earthed.

With protective systems employing earth returns there was a danger that part of the current might flow in a parallel earth path, such as the pans forming the conveyor, and produce open sparking. So far as was known no ignition of gas or coal-dust had been caused in this way, but experiments had shown that the spark so produced was capable of ignition. Although not at present compulsory, manufacturers were on the recommendation of the Mines Department now embodying features to render harmless any spark generated in this way.

Star-delta and auto-transformer motor starters were generally of the industrial pattern housed in certified flameproof enclosures. For main and tail haulages on undulating roadways and direct rope haulage downhill from the engine speed control was essential, and usually effected by either liquid or drum controllers with metal resistances in the rotor circuit. For endless rope haulage a liquid starter was usual, the motor being fitted with brush-lifting and short-circuiting gear. All switchgear was either of the draw-out type or fitted with isolating switches.

Motor and transformer requirements were similarly outlined in brief, the author's main object being to point out how widely industrial and mining circumstances differed from one another.

As part of a campaign for increasing its sales the Budapest Electric Co. is opening a number of new branch offices in various parts of the city. The attractive layout of one of these is illustrated in the accompanying photographs. The upper pictures are of the frontage and an exhibition of kitchen appliances. Below are the entrance hall, with water heater display, and the service department

Intensive Mining

SUSTAINED discussion indicated the importance that was attached to a paper presented by Mr. J. V. Spence at a recent joint meeting of the Ayrshire Sub-Branch of the Association of Mining Electrical Engineers with the Scottish Branch of the Colliery Managers' Association.

The subject was "Density of Intensive Mining," which the author said needed to be discussed with tact. With the aid of a series of data charts, plotted from actual records, he showed how attention was constantly focused on various

impress maxima. For example, in thin and wet seams time margins of water collection (measured in seconds) varied in comparative values with the cube of the coalcutter plug height. Thus designers of 12-in. cutters would appreciate the substantial help afforded by maximum plug height. Some type of flexible armoured waterproof connection to the coal-cutter might yet be made with a plug and control gear at the roadhead and pilot equipment operating mechanically on the machine.

To counteract the small margin furnished by the plug-cum-thinness factor one turned to the pump for help, but then right away encountered the time limit (measured in minutes) before rising water left insufficient space for air to pass. Thus the degree of intensity had been a race with time, and in the cases cited the factor of importance was the pump. No matter what overload or leakage occurred elsewhere in the pit, it must have voltage; discriminative protection was a suitable method of avoiding insecurity.

There was a relationship between comparative kWh used per ton of coal for various thicknesses of thin seams. In circumstances requiring the coalcutter to work with the trailing cable permanently on the side and restriction was the operator's major difficulty, there would be much stress of cutting with frequent starting and stopping. Diversity would be at the maximum and, unless water and depth were considerable, the cutting shift would present the heaviest load. For the same tonnage the feeders lengthened with the thinning of the seam and large relative voltage drop, coupled with necessary but promiscuous diversity, demanded persistent attention. The only solution was to keep the high-voltage source close up.

Conveyors might ameliorate the intensity arising from ventilation-cum-thinness limitations; but how was it proposed to get big coal on to the conveyor when the 12-in. machine had tight stretches in the run? When considering the size and power of plant and control gear to be installed in a thin seam it might be wise to budget for handling dirt. In the morning there was a rush to get rid of dirt, followed by an equal rush to make up for lost time. Modern equipment could stand considerable punishment. When a little extravagance in overload capacity would clear up the place, the temptation was great.

Coal mine planning schemes could not ignore localities and directions of sustained loading, zones of major diversity and contours of anticipated voltage drop. How valuable and comforting it was to foresee that things only required to be done once! Although a coal mine did not seem to the author to be a fertile situation for an engineering Utopia, it certainly offered opportunities for those who personally valued the prestige of well directed intelligence.

A noticeable, though silent, feature of impress mining was the stimulation of faith in the value of indirect results. The author believed this had been brought about by the utilisation of full discriminating protection. Thus with the elimination of fuses the "live juice" had been handed over to engineers for good. The operator could no longer retreat to his old-time "combination of events," for remote control revealed the need for the immediate correction of his irregularities in no uncertain manner.

Eire-Northern Ireland Link?

INTERCONNECTION of the electricity systems of Eire and Northern Ireland was envisaged by Mr. Sean MacEntee, Minister for Industry and Commerce, in Eire last week when he spoke at the University College, Dublin, on a paper read by Mr. P. G. Murphy, B.Sc., M.I.E.E. Such a link would be a great benefit, said Mr. MacEntee. It did not necessarily follow that under normal circumstances the exchange of power would be very large, but undoubtedly the interconnection would help to reduce the amount of stand-by plant required to meet emergencies, and would enable provision to be made for security of supply at a far lower cost than could be made by either system independently. Perhaps this was one of the developments which the present abnormal situation might help to hasten.

Discussing power resources in Eire, the Minister said investigations had shown that the erection of a peat-burning generating station would be quite a practicable proposition. In his opinion conditions arising out of the present war would not impede the realisation of that project, but rather compel them to carry on with it with the greatest possible expedition.

Next to the Shannon and the Liffey, the Erne and the Boyne appeared to be the most important rivers from a hydro-electric point of view. The Boyne might produce an additional 100 million kWh per annum, but its development might be very unsatisfactory owing to high rates of compensation to landowners. The Erne, if satisfactorily developed, might give an annual output of 200 million kWh, or almost seven times what the Liffey might be expected to give in an average year. But the position in regard to the Erne was not a simple one, because its storage facilities and a large part of its catchment area lay within the six counties—a fact which had created a very difficult problem in drainage for the Northern Government. It would be quite possible, he thought, to develop the hydro-electric potentialities in such a way as to improve considerably the drainage in the area affected, but proposals on these lines would require the active co-operation of their friends in the North.

Mr. Murphy, in his paper, mentioned that since 1930 the kWh produced by E.S.B. stations had grown from 60,949,000 generated for 48,505 consumers, to 377,637,000 generated in 1939 for 160,382 consumers. He thought it a conservative estimate to assume that the present output would be doubled within the next decade.

Diesel Engine Operating Costs

THE report on heavy-oil engine working costs compiled yearly by the Diesel Engine Users' Association was considered at a meeting in London on March 14th.

Notwithstanding prevailing conditions the returns made by members were as complete as those of previous years. In 1938-39 the average fuel consumption of 58 stations (17 fewer than in 1937-38) decreased slightly to 0.634 lb. per kWh generated. The average load factor (running plant) rose somewhat to 63.9 per cent., representing a fuel consumption 4.5 per cent. below the standard reference curve. The lubricating oil consumption of 28 stations was better than the arbitrary standard of 2,380 rated BHP-hours per gallon, three of them exceeding 6,000.

Thirty-two home stations containing 158 engines totalling 50,344 kW generated 48,676,379 kWh, the maximum load being 41,444 kW and the annual station plant load factor 11 per cent. Fuel oil used was 0.622 lb. per kWh generated, totalling 13,489 tons and costing £4 18s. 6d. per ton. Lubricating oil totalled 43,725 gallons, costing 2s. 6¾d. per gallon, representing 2,570 BHP-hours per gallon. The report includes comparative figures for 26 overseas stations, as well as renewals and replacement costs, liner wear data and long period running costs.

Among returns relating to waterworks, those from Egypt afford a useful comparison between pumps driven direct by engines and by motors deriving electricity from Diesel generating sets. The fall in the value of the Chinese dollar has considerably affected the costs of electricity and fuel oil in terms of local currency; nevertheless at Shanghai it is still more economical to operate electric pumps as base load units, the Diesel generating sets being regarded as standby plant.

Air-conditioning in Ships.—The air-conditioning of passenger and cargo spaces in ships was discussed in a paper by Mr. W. H. Glass (technical director, Thermotank, Ltd.) which was read before the North-East Coast Institution of Engineers and Shipbuilders at Newcastle-upon-Tyne on March 29th. Physiological factors relating to body comfort were explained as well as the relation of temperature and humidity to comfort. The several sources of heat, including lighting, were detailed and attention was directed to problems associated with isolation, air delivery and distributing ducts.

Small Magnets

PERMANENT magnets too small for economic and satisfactory manufacture by casting are being made of powdered "Alnico." The practice of the General Electric Co. of America is to pre-form the metallic "dust" in automatic mechanical and hydraulic presses before sintering. The smaller sizes ranging from one-fifth to 1/224 oz. in weight are preshaped in tablet-making machines and loaded into "boats" for passage through the hot zone of the sintering furnace, thence into an extension zone where cooling is so controlled as to ensure optimum qualities, which depend largely upon the state of dispersion of the nickel-aluminum compound. In this respect the lighter element is a complication, since it is so readily converted into an inert oxide which is not reducible by the hydrogen atmosphere in the furnace. Instead ferro-aluminium is introduced, which is more free to combine with the other metals.

Small magnets made in this way can be mounted with the aid of soft solder and the usual zinc chloride solution flux, after preliminary removal of aluminium from the surface by etching. Similarly, iron pole faces can be attached, while pins or sleeves inset in the pressed mixture will be anchored by shrinkage during the sintering. Iron powder deposited on top of the powdered "Alnico" mixture in the mould prior to pressing provides a backing which can be drilled and tapped, but this method of mounting can only be utilised when partial shunting will not occur.

ELECTRICITY–GAS "TRUCE"

Recommendations of Joint Committee

MUCH has been said lately regarding the conclusion of a "truce" between electricity and gas supply authorities, but hitherto little has been known about it. The question first arose when the Fuel and Lighting Order was issued, and both electricity and gas suppliers considered it necessary to make representations to the Secretary for Mines regarding the unsatisfactory nature of the Order.

The gas industry held the view that the rationing of gas was entirely inimical to a policy of coal conservation. They had previously made representations to the Mines Department, who in consequence amended the Order in certain respects, notably by the exclusion of prepayment consumers of gas from rationing. The electricity supply industry had also made representations that the black-out had already brought about an appreciable reduction in the consumption of electricity and that its further rationing was unnecessary. It was shown that certain provisions of the Order were calculated to react unfairly upon the electricity supply industry *vis-à-vis* the gas industry.

Origin of the Committee

In consequence of these independent representations, the Mines Department issued an invitation to the National Gas Council and the associations representing electricity supply undertakings to a joint conference at the Mines Department for the purpose of making an endeavour to reach agreement in regard to the representations which had been made. A preliminary meeting between the gas and electricity representatives was held in private previous to the conference, and it was decided that they should jointly emphasise once more that in their view the rationing of either gas or electricity was altogether wrong, and that it should be left to the gas and electricity representatives to consider the matters at issue with a view to reaching agreed recommendations in regard to amending the Order. This proposal for joint consultation was readily accepted by the Mines Department. The gas and electricity representatives then proceeded to sit as a Joint Committee with Mr. R. W. Foot as chairman and Mr. John Mould as vice-chairman.

A preliminary discussion revealed that a necessary introduction to a complete agreement regarding to the form of the Order and its subsequent operation was that an understanding should be reached between the two industries in regard to their activities. On this basis a memorandum was prepared and submitted to the Secretary for Mines setting out recommendations for the amendment of the Fuel and Lighting Order.

The memorandum, after dealing fully with the case for total exclusion from rationing, set out as a sort of basic recommendation that in connection with the administration of the Order the gas and electricity representatives in each district should act as assessors to the local fuel overseer in relation to all questions affecting rationing, and should be given certain definite powers to be exercised jointly. It recommended that all consumers of electricity by prepayment meter should be excluded from the operation of the Order in the same manner as consumers of gas by prepayment meter had already been excluded, and it also recommended an increase in the minimum ration of electricity in cases where electricity was used for cooking. A further recommendation was that this ration should be applicable also in cases where electricity was used for water-heating. It was considered that the Order should be limited to domestic premises, to the exclusion of all industrial premises, and that some restriction should be placed on the use of fuel oil for all purposes.

Minister's Views

Having considered the memorandum, the Secretary for Mines stated that he was not convinced that the complete exclusion of gas and electricity from rationing was desirable at that stage. He also stated that a decision of the two industries to reach agreement in regard to their activities would be a valuable contribution towards national co-operation, and that he was prepared to accept in principle a substantial part of the recommendations for the amendment of the Order.

At a later conference the Secretary for Mines stated that as a result of further considerations of the memorandum submitted by the Joint Committee the Government was prepared forthwith to repeal the Fuel and Lighting Order in so far as it related to gas and electricity, and to draft a new Order substantially embodying all the recommendations of the Joint Committee. This Order would not, however, come into force unless and until a change in existing circumstances should make it necessary to reintroduce fuel rationing.

In reporting these matters the Joint Committee says that it is well aware that it has received no mandate from the respective associations to agree the terms of the understanding between the two industries but, having based its recommendations upon the assumption that such an understanding would be made effective, it feels it necessary to set out in general terms its views as to the manner in which effect should be given to this understanding.

The Committee is convinced that both industries would be making the greatest possible mistake were they to allow any understanding to have the effect of withdrawing either industry from every proper activity consistent with the present circumstances. It is recognised that wartime conditions are so materially different from peacetime conditions that the activities and publicity work of each industry should be properly co-ordinated and reconciled with the wartime atmosphere, but that the understanding should have the effect of withdrawing either industry from its public would, in the opinion of the Joint Committee, be absolutely wrong. These activities could and should be conducted upon the basis of a proper understanding between the two industries, and the Committee, therefore, makes recommendations: First, it is proposed that whilst the understanding should not operate to check the activities of either industry in the securing of new business, there should be eliminated completely from all such activities and from all future propaganda statements or suggestions of a damaging or disparaging nature. With a view to achieving this object machinery should be provided for enabling consultation to take place in regard to the subject-matter of national publicity and propaganda. Closer co-operation should be encouraged regionally between the representatives of the respective industries engaged in sales and publicity work, and it is proposed that there should be established a National Joint Committee to which could be referred all matters of importance arising in connection with the understanding between the two industries, whether nationally or regionally, and which would act nationally in so far as might be necessary in all matters connected with the drafting or administration of the new Fuel and Lighting Order.

Basis of Understanding

In submitting these recommendations the Joint Committee says that it is particularly impressed with the importance of the following considerations:—

(*a*) That an understanding on the broad lines of its recommendations is to all intents and purposes essential if the two industries are to act together in connection with the drafting of the new Fuel and Lighting Order and its administration if and when introduced.

(*b*) That while the Joint Committee feels that each industry should continue to maintain all proper contact with its consumers and should also be as active in regard to new business as wartime conditions may from time to time seem to justify, it also feels that the understanding might with advantage in present circumstances lead to arrangements in each locality designed to prevent the displacement of the existing apparatus of either industry.

(*c*) That if the report and its recommendations receive the approval of the various national organisations the report should be circulated to each individual undertaking in both industries with the blessing of its national body, and that all possible steps should be taken to ensure the recommendations becoming generally effective.

The Committee says that it feels strongly that nothing could be worse for the future relationship between the two industries than the existence on paper of the terms of an understanding and mutual co-operation which did not receive both nationally and regionally the reality of translation into actual and day-to-day practice.

The members of the Joint Committee are as follows:—Representing electricity: Messrs. J. Mould, B. Handley and H. C. Lamb (Incorporated Municipal Electrical Association); Messrs. J. C. Dalton and A. J. Fippard and Brig.-Gen. Wade H. Hayes (Joint Committee of Company Associations); and Messrs. L. Gordon and H. F. Carpenter (Conference of Joint Electricity Authorities, &c.). Representing gas:—Messrs. R. W. Foot, E. V. Evans, J. Jamieson, T. P. Ridley, C. S. Shaply and A. W. Smith (National Gas Council). The joint honorary secretaries are Messrs. E. J. Fottrell (National Gas Council), A. Home-Morton (Joint Committee of Company Associations), and J. W. Simpson (I.M.E.A.).

CORRESPONDENCE

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions

Fields for Development

IT is possibly not generally realised in the electricity supply industry that plans of evacuation including redistribution of families have provided abnormal fields of development for electricity in urban and rural areas. Salesmen have, in the past, complained that prospective consumers in these types of districts have not adopted electricity extensively, as their existing methods were and had been sufficient for very many years.

For instance, in farmhouses it is common practice to use coal ranges all the year round and separate water heaters and cookers have been regarded as redundant. Spare rooms in these houses have, in many instances, recently been let to town people who naturally do not appreciate country methods. Where "evacuees" have been taken in it is also found that existing arrangements are inadequate. Provided encouragement is received from the electricity authorities these town people will sell "modern" ideas to the "hosts." It is imperative, therefore, that salesmen should make themselves acquainted with all instances where evacuees or guests have been taken into consumers' houses. Visits should be paid as early as possible to ascertain their requirements. Visits should at the same time be paid to consumers who use electricity extensively as it is possible, otherwise, that the existing electrical apparatus will be inadequate and may be changed for other methods. Development on these lines is practically unlimited, and once apparatus is installed it should provide a steady income over a period of years.

Besides "heavy" apparatus lighting must not be neglected. The small wattage bulbs installed at the outbreak of war have, to a large extent, remained although black-out arrangements have improved. As an introduction salesmen could profitably study black-out methods and advise the consumer on this question as a preliminary to overhauling the lighting arrangements. Points on the question of black-out might usefully form part of a "Better Light—Better Sight" campaign.

G. A. T. BURDETT.

Petts Wood, Kent, *March 15th.*

Foreign Qualifications

As a constant reader of the ELECTRICAL REVIEW for many years I have read in your valuable journal from time to time discussions on all manner of things, but I cannot remember seeing anything on the value of foreign qualifications. Perhaps this is not a very appropriate time to raise this matter but since it has engaged my attention as well as that of my friends for a considerable time, and I am already an associate of the American Institute of Electrical Engineers and propose to apply for full membership, in addition to making application for membership of the American Society of Civil Engineers, I would much appreciate your assistance to determine the commercial value of these qualifications.

From an academical point of view I think the journals of the above bodies are extremely useful, for not only do they show the trend of engineering practice abroad but also broaden one's social and commercial knowledge as the latter subjects are liberally dealt with by the American societies. It may be said by some that the annual subscriptions take money out of the country and thereby add to any adverse trade balance by increasing the invisible imports.

Assuming that what difficulties there may be are not important enough to prejudice these qualifications, other things being equal, would an employer consider A.M.I.E.E., M.Amer.I.E.E., or A.M.I.E.E., M.Am.Soc.C.E., or the combination of all three a far greater recommendation for an engineering appointment in the heavy side of electrical engineering than A.M.I.E.E. alone? MIDLANDER.

March 15th.

Chief Engineers' Salaries

Although unconnected with electricity supply and unable to offer any opinion as to the procedure adopted in regard to settling chief engineers' salaries, one can only be dismayed at the defeatist attitude shown by "Constitutional" in your issue of March 15th. My interest in the subject is that the progress of electricity as a whole undoubtedly depends largely upon having the right men in senior executive positions in the supply section of our industry.

Experience shows that a man without the background provided by technical training is severely handicapped in the practical administration of any engineering undertaking. This view is supported by the fact that large numbers of engineers are directors as well as managers of important manufacturing and supply undertakings, which are commercial concerns and out to earn dividends.

An electrical engineer who doubts his ability to compete with untrained men should, obviously, not make the attempt. It is true that non-technical men of outstanding ability have often justified their appointment to the highest posts as a result of personal qualifications that have been exceptional enough to surmount difficulties due to lack of specialised training. Such appointments, however, are clearly not due to a willingness to accept a meagre salary.

Your correspondent's view appears to have as its logical outcome that an engineer cannot hope for promotion unless he is willing to work for the kind of salary that the most unenlightened municipality would offer to a bright clerk to run its undertaking. That, if true, would be the strongest argument yet offered in favour of a drastic reform of distribution. Only adequate remuneration can secure the best men required to develop electricity supply so that the needs of the public can be met in the way that they ought to be.

March 19th. ID EST.

I have to refer to the letter from "Constitutional" which, under the above heading, appeared in your issue of March 15th, in which he refers to certain protests "representing 40 per cent. of the E.P.E.A. membership" which, it is alleged, have been officially made to the A.M.E.E., and to emphatically deny any such protests as suggested or that any criticism in the E.P.E.A. membership of the Association's action in this matter amounts to a tithe of the figure quoted by "Constitutional."

W. ARTHUR JONES.

London, S.W.1, *March 18th.* *General Secretary.*

London Electricity Charges

Sir W. Davison asked the Minister of Transport whether he could now give particulars of the report he asked for from the Electricity Commissioners with reference to the large increase in charges for electricity of Central London Electricity, Ltd., and other companies; and what action he was taking in the matter.

Mr. Bernays, Parliamentary Secretary to the Ministry of Transport, said that the Electricity Commissioners had carefully examined the detailed estimates of income and expenditure and supporting data upon which Central London Electricity, Ltd., had based its increased charges and had advised the Minister that they saw no reason to dispute the estimates. Those estimates provided for earning a dividend of less than 5 per cent. on the ordinary stock of the Company, as compared with the standard dividend of 7 per cent. under the Company's sliding scale of prices and dividends and were made on the basis that the sales of electricity in 1940 would be only 70 per cent. of the sales in 1938.

It would be appreciated that the Company's costs were mainly fixed costs which it could not avoid and that with such a considerable decrease in sales, the result must be a material increase in the costs per unit apart from other increased costs due to the war. Whether the Company's estimate of decreased sales would or would not prove to be correct depended upon factors which it was impossible to forecast, and any appreciable variation in either direction would materially affect the results of the Company's operations. In those circumstances, while not proposing to intervene at the present stage, he intended to review the position at the end of the first six months of the current year.

He was expecting to hear from the Electricity Commissioners at an early date with regard to the charges of the Notting Hill Electric Lighting Co.

Mr. Lyons asked why there was such a great differentiation in charges throughout the country. Mr. Bernays replied that it was largely due to differences in the scale of evacuation. Obviously the greatest amount of evacuation had taken place from Central London.

Replying further to Mr. Lyons, Mr. Bernays said that a statement of the increases which had been made in electricity charges was in course of preparation by the Electricity Commissioners as the outcome of a communication which they had addressed to all electricity supply undertakings in January.

PERSONAL AND SOCIAL

Information regarding new appointments and other matters of interest for this page are welcomed

REFERENCE o the ability, courtesy and tact of **Mr. G. K. Paton** was made at the recent quarterly meeting of the North Wales and South Cheshire Joint Electricity Authority by Ald. A. Hewitt, the chairman, who moved that the Authority should place on record their appreciation of Mr. Paton's long association with them now that for health reasons he was compelled to relinquish his post as engineer and manager to the North Wales Power Co. The Authority was greatly indebted to him for his help and they were glad to know that Mr. Paton (who remained as resident director) would still be a member of the Joint Authority. As we have already reported, **Mr. R. A. S. Thwaites** has succeeded Mr. Paton as engineer and manager of the North Wales Power Co. and Electricity Distribution of North Wales and District, Ltd.

We are glad to hear as we go to press that **Lord Hirst** is making slow but steady improvement after his attack of influenza.

Dr. T. A. McLaughlin, M.Sc., B.E., Ph.D., chairman of the Electricity Supply Board, Eire, has received the honorary degree of Doctor of Science from the National University. The degree was conferred by the Chancellor, Mr. de Valera.

Lt.-Colonel B. H. Leeson, T.D., M.I.E.E., in his thirty-second year of service in the Territorial Army, has relinquished command of his unit "somewhere on active service," the Minister of Supply having represented to the War Office that in the national interests of production and export he is required for special duties in his engineering capacity as a drector of A. Reyrolle & Co., Ltd.

Mr. B. Rabbetts, contract engineer with W. T. Glover & Co., Ltd., who as a lieutenant in the Territorial Army was mobilised at outbreak of hostilities, was released from military service in February. He is engineer-in-charge for W. T. Glover & Co., in connection with the laying and jointing of 22-kV cables for the L.P.T.B. and L.N.E.R. electrification scheme, Liverpool Street to Ongar and Newbury Park, and has been released from military service to complete this contract which in its amended form calls for the laying of 50 miles of 22-kV cable.

Mr. D. H. Ray, of the S.W. & S. Electric Power Co., has been nominated for the chairmanship of the South Midland Students' Section of the Institution of Electrical Engineers.

Mr. James F. Ryder has been elected president and **Mr. P. Abels** (Briscoe Importing Co., Ltd.) vice-president of the Executive Council of the Society of Irish Electrical Traders.

Mr. R. Stanley, who was appointed acting manager in Australasia of British Insulated Cables, Ltd., on the retirement of Mr. H. C. Newton last year, has now received confirmation of his appointment and became manager in Australasia on January 1st.

At the annual general meeting at Rangoon, on January 24th, the Association of Engineers in Burma elected as president **Mr. E. J. Taylor,** manager of the General Electric Co. (Burma), Ltd., the G.E.C.'s branch company in Burma.

Mr. R. Macdonald has been appointed sales manager of the British Luma Co-operative Electric Lamp Society, Ltd., Govan, Glasgow.

Consequent upon the retirement of **Mr. A. C. Hansen,** chief clerk in the Liverpool Electric Supply Department, **Mr. J. McMinn,** at present assistant to the chief clerk, has been appointed chief clerk.

The Prestatyn Urban District Council has decided that as **Mr. W. R. Kelly,** the electrical engineer, is going on service with the R.A.F., **Mr. D. R. Stewart,** a member of the staff, shall be appointed to deputise for him during his absence. The Council has also adopted a recommendation of the Finance Committee that steps shall be taken to secure the services of a technical adviser.

Mr. J. W. McKay has been appointed director of sales for Graham Farish, Ltd. Mr. McKay is well known in the electrical industry, having at one time been general secretary of the Electrical Wholesalers' Federation for six years, and later director of sales for Marconi's "Visatone" sound-recording system. He was also in Prague for a period, where he was engaged on the development of export trade.

The Minister of Supply has appointed **Mr. W. T. V. Harmer** to the position of Controller of chrome ore, magnesite and wolfram. The offices of the Control are at Broadway Court, Broadway, Westminster, S.W.1.

Mr. D. D. Leitch, B.Sc., Greenock, has been appointed an assistant electrical engineer at the Admiralty, under the Director of Electrical Engineering. Mr. Leitch served his apprenticeship with Messrs. Scotts, shipbuilders, and afterwards occupied a post with Vickers-Armstrong, which he now vacates to take up his new position.

Obituary

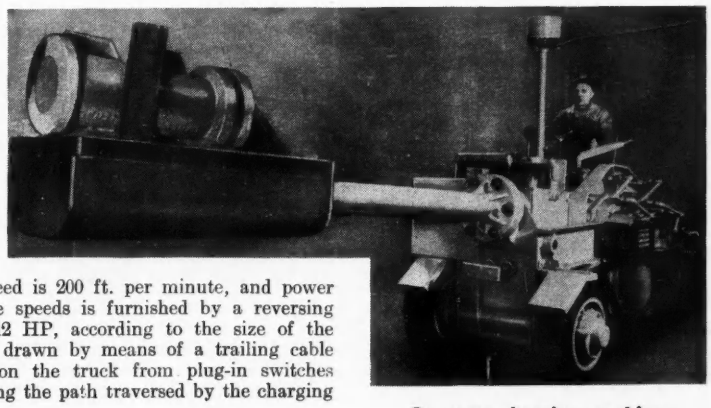
Mr. S. A. James, who has died at Forres, Morayshire, was associated with the telegraph service over a long period. A native of Bristol, Mr. James entered the employment of one of the private telegraph companies, and later, on the transfer of the private companies to the Government, he was for many years in the telegraph departments at the head Post Office, Glasgow, eventually becoming chief superintendent. In 1903 he became postmaster at Chester, retiring in 1908. Mr. James was ninety-three years of age.

Mr. A. P. Rutherford.—The death occurred suddenly on March 14th, in Edinburgh, of Mr. A. Peden Rutherford, of Edinburgh. Mr. Rutherford was for many years chief electrical engineer of Leith, retiring from that post on the amalgamation of Leith with Edinburgh several years ago.

Electric Furnace-charging Machine

AN interesting and unusual type of electrically operated and propelled furnace-charging machine has recently been installed in the works of F. H. Lloyd & Co., Ltd. It is of the box charging type suitable for dealing with loose material and scrap, which has to be deposited within the furnace.

This mechanical charger is in effect a three-wheeled truck mounted on rubber-tyred wheels, which requires no track but simply a reasonably good floor for operation. It can be readily manoeuvred to turn through a complete circle within the space of its own wheel-base. The usual travelling speed is 200 ft. per minute, and power for forward and reverse speeds is furnished by a reversing motor of some 10 or 12 HP, according to the size of the charger. Electricity is drawn by means of a trailing cable attached to connector on the truck from plug-in switches conveniently located along the path traversed by the charging machine.



Box-type charging machine

The design of the charging arm can naturally be varied according to the nature of the load to be handled. For example, there is the tong-action type designed to handle blooms up to 1 ft. 6 in. wide by 12 ft. long having a maximum weight of some 1,500 lb. Tilting of the arm and operation of the tongs is effected by means of oil cylinders actuated by a pump driven by a separate motor, which may vary from 12 to 20 HP according to the duty.

Compared with other methods of furnace charging, this system is stated to be very low in first cost; it leaves the floor in front of the furnace free from all obstruction, and makes extensive runways unnecessary, while its convenience in manoeuvring enables it to be used in very congested areas. The rapidity with which a full furnace load can be charged by this method is also a marked feature. It may be added that this type of furnace charger has now been applied to charging Siemens-Martin furnaces, for handling ingots, billets, slabs, boxed work for case-hardening and annealing, and for charging dolomite cupolas and glass furnaces.

NEW BOOKS

Arc Convertor Theory. High Frequency Currents. Industrial Law

The Fundamental Theory of Arc Convertors. By H. Rissik. Pp. 283; figs. 78. Chapman & Hall, Ltd., 11, Henrietta Street, London, W.C.2. Price 18s.

This is a thorough and profound treatise. Much of the subject matter appears here for the first time and much is only to be found scattered among papers and articles in various countries. The author is well qualified to undertake the task of writing an authoritative work on this subject as his own contributions to the theory have been considerable. The book is divided into three parts entitled respectively, "The Normal Rectifier," "The Grid-controlled Rectifier," and "The Invertor and Cyclonconvertor," the last part covering very recent developments. These are preceded by three prefaces and an introduction. Only the last of these, which is a brief history of arc convertors, can be said to contain information worth speaking of. Why do publishers and authors think that their work needs so much explanation? Perhaps an engineer will one day write a book which begins with Chapter I. This book might certainly have been allowed to speak for itself.

It is concerned neither with the physics of the arc nor with constructional problems, but deals exclusively with the circuit theory. The very complicated relations between voltage, current and power are worked out fully; it is shown how harmonics both on the DC and the AC side can be calculated and what the rating of the transformer must be for a given DC output. Various methods of connecting transformers to give a multi-phase supply are discussed and compared in detail; conditions under inverted working are investigated and it is shown how and when the convertor can deal with reactive power.

The treatment is mathematical throughout and the skill with which suitable expressions are reached is admirable. The reasoning is, however, not always easy to follow. On page 19, for instance, it is shown that the differential coefficient of a certain function is zero. From this, says the author, it follows that the function is zero. For the physical conditions considered the conclusion happens to be correct except for a small error introduced by the transformer magnetising current. But it is asking rather much of the reader to expect him to discover this for himself.

Apart from this, the form of many mathematical expressions is inevitably very elaborate even when the final equation turns out to be quite simple. This could not be avoided with the available mathematical methods, for many expressions deal with sine waves out of which pieces of various shapes have been cut. Is it too much to hope that someone will develop a mathematical shorthand which will enable such functions to be handled in a more elegant way?—R. O. K.

High Frequency Alternating Currents. By KNOX MCILWAIN and J. G. BRAINERD. Second edition. Pp. 530; figs. 226. Chapman & Hall, Ltd., 11, Henrietta Street, London, W.C.2. Price 30s.

In the preface of their new edition the authors express surprise that a book on the mathematical analysis of electric circuits at high frequencies should have exhausted a first edition. The reviewer offers the explanation that many of us as students failed to keep our lecture notebooks as satisfactorily as our professors wished; in consequence, we are now glad to turn for reference to a well ordered book for the forgotten information.

The work is very comprehensive, and closely follows a university curriculum for electrical students on the subject of radio communications. Certain chapters on coupled circuits and electric wave filters are excellent, but it is doubtful whether the authors have not gone a little too far in their treatment of electro-mechanical systems through the introduction of Lagrange's equation, to retain the extremely practical bearing which is characteristic of the rest of the book. Nevertheless, the book forms a most useful work of reference for both engineers and students, and will no doubt require a third edition in due course.—C. M. R. B.

Theory of Machines. By LOUIS TOFT and A. T. J. KERSEY. Pp. 474; figs. 284. London: Sir Isaac Pitman & Sons, Ltd., 39, Parker Street, London, W.C.2. Price 12s. 6d.

Pitman's Engineering Degree Series of books comprises a number of texts whose standard is sufficiently indicated by this general title. Such a series is a great advantage to students of engineering, as it provides them with a range of subjects whose exposition, though by no means co-ordinated, is co-related by the common purpose of their several authors. The excellent production, clear print, well-drawn diagrams and effective layout of these books is a considerable aid to their study and the particular one of these now under review has fully established its value in its own branch of engineering.

Originally published twelve years ago, it is now in its fourth edition, and though changes have been made in successive issues, these, apart from minor corrections, have been in the direction of the inclusion of such new material as has been found necessary.

In this edition the new matter includes an extension of the treatment of the theory of oscillations so as to cover the general case of a plane mechanism elastically constrained at one point and a more systematic treatment of this branch of dynamics. A study of torsional oscillations of two shafts connected by gearing is also inserted, a case of some importance to electrical engineers in relation to motor driven gearing. Equivalent non-elastic rotational systems have been introduced and greater prominence is given to equivalent dynamical systems.

But it is not merely by the extent of the subjects introduced that the book is useful. The student will appreciate the authors' clear exposition of the principles and their application as even more valuable. These and the numerous worked examples will be found both by the student and the practising engineer to fulfil their respective needs.—J. A. C.

Industrial Law. By H. SAMUELS, M.A. (Second edition). (Pp. 249.) Sir Isaac Pitman & Sons, Ltd., 39, Parker Street, Kingsway, W.C.2. Price 15s. net.

The consolidation of a great deal of existing industrial law in the Factories Act of 1937, to say nothing of alterations in insurance legislation, has created a number of new points since the first edition of this work was issued.

In a comparatively small compass Mr. Samuels has packed an enormous amount of well-digested information upon a complex subject. Mention of some of the section headings will indicate the wide scope of the work: Law concerning apprenticeship; contract of employment; wages; conditions of work in factories; mines; workmen's compensation; trade unions and associations; National Insurance; co-operation schemes and voluntary welfare; conciliation and the settlement of disputes. An appendix dealing with recent emergency legislation brings the book up to date.

In some instances the author has had to summarise rather drastically, e.g., in his very brief paragraphs on ventilation and lighting, but on the whole sufficient attention is given to the many aspects of the subject to afford general guidance to the factory management.—J. H. C.

Shorter Notices

"Records and Research in Engineering and Industrial Science." By J. Edwin Holmstrom. Pp. 302. Chapman and Hall, Ltd., 11, Henrietta Street, London, W.C.2. Price 15s. This work is intended as a guide to the production, extraction, integration, storing, circulation, and translation of technical knowledge. It points out that provided one is master of the fundamentals the sources of knowledge available are unlimited. The author indicates the various experimental and collative organisations now in existence. The gathering of ideas from technical literature is then dealt with, followed by chapters on the sorting, integrating, expression and transmission of ideas, and foreign languages and their translation.

"Definitions and Formulæ for Students." By F. Peake Sexton. Fourth edition. (Pp. 27.) Sir Isaac Pitman & Sons, Ltd., Parker Street, London, W.C.2. Price 6d. Although it is labelled "for students" this useful little booklet provides the data necessary to the daily work of wiremen and installation engineers.

"Cathode-Ray Oscillographs." By J. H. Reyner. Pp. 177; figs. 128. Price 8s. 6d. "Metallurgical and Industrial Radiology." By Kenneth S. Low. Pp. 88; figs. 42. Price 7s. 6d. "Engineering Economics: Book II—Works Organisation and Management." By T. H. Burnham. Pp. 375; figs. 74. Price 10s. 6d. Sir Isaac Pitman & Sons, Ltd.

"Electrical Engineering Science." By Arthur Morley and Edward Hughes. Pp. 256; figs. 152. Longmans, Green & Co., Ltd., 39, Paternoster Row, London, E.C.4. Price 5s.

"The Calculation and Design of Electrical Apparatus." By W. Wilson. Pp. 230; figs. 24, and tables. Chapman & Hall, Ltd. Price 10s. 6d.

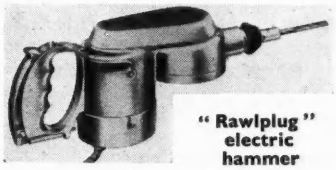
"Radioactivité et Transmutation des Atomes." By Théodore Kahan. Pp. 224; figs. 35. Librairie Armand Colin, 103, Boulevarde Saint-Michel, Paris. Price: paper cover 15 fr.; bound, 17 fr. 50 cents.

NEW ELECTRICAL PRODUCTS

A Review of Equipment Recently Marketed

Electric Hammer

AN electric hammer announced by the RAWLPLUG CO., LTD., Rawlplug House, Cromwell Road, S.W.7, is suitable for boring holes up to ⅜ in. in diameter in hard material such as concrete, brick, stone, &c. It is especially useful for "Rawlplug" fixing, but can be also employed for hacking, pointing and chase cutting.



"Rawlplug" electric hammer

Its ½-HP motor runs at 4,500 RPM and is suitable for either AC or DC. Blows are delivered by a patented mechanism consisting of two spherical steel balls rotating inside a cylindrical rotor under control of a special type of cam which makes a well-balanced unit with practically no vibration. As two blows are delivered per revolution and the speed of the hammer is 1,500 RPM, the number of blows per minute is 3,000. When the hammer is idling, the blows are cushioned so that no damage is done to the tool holder or hammer case. The aluminium die-cast hammer case, although light, is extremely robust. Its comfortable handle, when firmly gripped, automatically switches on the motor.

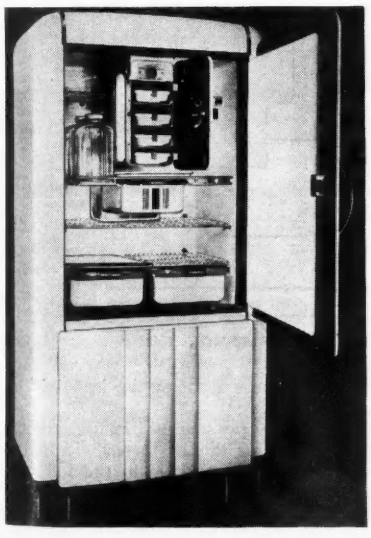
Emergency Lighting Equipment

To comply with the new BS/ARP/26, F. C. HEAYBERD & Co., LTD., 10, Finsbury Street, E.C.2, have introduced the new "A.R.P.26" emergency lighting unit. This equipment is suitable for use in conjunction with a 12-V, 30-Ah car battery to provide a load up to 40 W (four lamps) under normal conditions, and 20 W (two lamps) under emergency conditions.

A transformer and metal rectifier are incorporated for recharging the battery after discharge, and the equipment is provided with a snap-action mains switch, emergency lighting change-over switch, battery charging switch, circuit fuses and clearly engraved terminal blocks. The well-ventilated sheet-steel case, measuring 12 in. wide by 8½ in. high by 7½ in. deep, is arranged for wall mounting. The transformer is double-wound, air cooled, rated for continuous operation and thoroughly impregnated to withstand adverse conditions, while the full-wave metal rectifier is designed to carry reasonable overloads without damage.

Refrigerator Improvements

Three new refrigerators are included in the 1940 range of eleven units offered by H.M.V. HOUSEHOLD APPLIANCES, Hayes, Middx. Special features of the "GO.4" and "GO.5" models, which have capacities of 4 and 5 cu. ft., are their all-steel cabinet construction, rubber grid ice tray, interior lighting, and synthetic enamel exterior finish. In these machines the freezing compartment is not sealed.



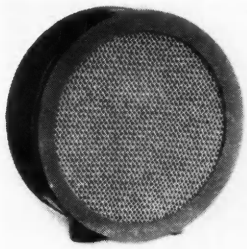
H.M.V. model "S.5" refrigerator

In the other new model, the de luxe "S.5," not only are the internal fittings and layout of very high standard, but a low temperature principle of operation gives improved food storage conditions, less dehydration of foods, less transfer of food tastes and quicker ice freezing. Other features are the vitreous porcelain finish inside and out, sealed freezing compartment, an improved de-frosting arrangement, special meat storage, separate compartments for salads and fruits, and two stoppered bottles for liquid storage.

The same "silent circulator" mechanism incorporating only three moving parts is used in all the models, the open type construction permitting easy interchange of motors of different voltages.

Portable Air Conditioner

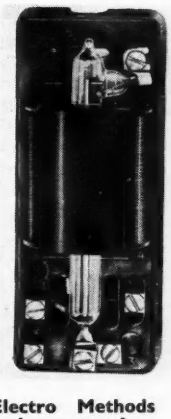
A portable air conditioner supplied by the AUTOZONE CO., LTD., 18, James Street, Oxford Street, London, W.1, will find favour for blacked-out rooms and air-raid shelters as well as for numerous other situations such as sick rooms, offices, hospitals, doctors' and dentists' surgeries, &c. Air is drawn in at the back through an oil-treated filter by means of a fan (loaded at only 60 W) and passed through a perforated container holding a tablet of essential oils with a strong germicidal action. Fresh, cool and purified air is emitted at the rate of 50 to 60 cu. ft. per minute. In summer the apparatus keeps rooms free from flies and other insects. The air conditioner weighs only 1½ lb. and is 12 in. high.



Autozone air conditioner

Microwatt Relay

Simplicity and dependability combined with high sensitivity and switching capacity are claimed for a new microwatt relay which ELECTRO METHODS, LTD., 15, Dartmouth Street, London, S.W.1, have just placed on the market. Although the energy consumption is only 0.01 W, the switching capacity of the main contacts is 250 W. The operating differential between "pick-up" and "drop-out" current is approximately 30 per cent. In a circuit with, for instance, 90,000 ohms resistance, the relay will still work safely even with corroded and oxidised contacts, having a short circuit resistance of 30,000 ohms. Models can be supplied for AC or DC.

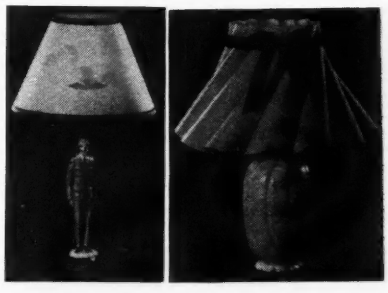


Electro Methods microwatt relay

The relay comprises two iron bars, riveted together on one side but having no metallic connection at the other. This unit is sealed in a glass tube and forms one part of two electrodes. The second electrode is sealed into a cup at the other end of the glass tube, which holds a pond of mercury. The glass tube as a whole forms the core of a coil which, if energised, magnetises the sealed-in iron bars referred to and causes a tungsten contact fixed on the lower bar to dip into the mercury and complete the circuit.

Attractive Table Lamps

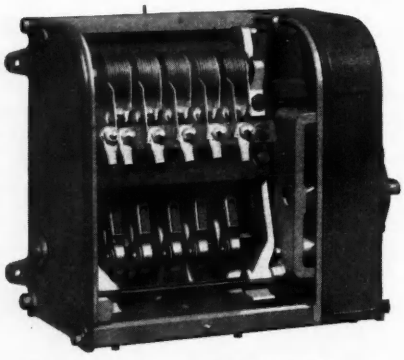
Among the many new designs of table lamps just introduced by WAITE & SON, LTD., Menin Works, Bond Road, Mitcham, is a topical range of lamps incorporating porcelain figures of soldiers, sailors and airmen, as well as one showing a bulldog chewing up a Nazi flag. The company's fittings as a whole have a strong tendency towards plain styles, individuality being achieved by means of the graceful shape of the base and shade and by delicate pastel colouring. In one of the models illustrated effective use has been made of plain white buckram relieved by velvet ribbon.



Waite & Sons "Airman" lamp and a unit with a neat buckram shade

Battery Vehicle Controller

In designing their pedal-operated controller for battery vehicles J. G. SMITHSON & CO., LTD., Melchett Road, Kings Norton, Birmingham, considered the essential features extreme simplicity, combined with thoroughly reliable and foolproof time-lag automatic acceleration. In addition, all parts have been arranged by the makers for exceptionally easy replacement.



Smithson battery vehicle controller

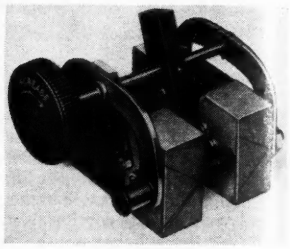
The controller is of the camshaft type, incorporating "Smithson" patent trigger-operated contactors, which give snappy opening and closing of the contacts, irrespective of how the controller is operated. Combined with this, the company's new air dashpot automatic accelerating device ensures that even if the foot pedal is fully depressed to the last notch while the vehicle is at rest, smooth automatic acceleration will take place.

The cam-operated contactors are of the new heavy duty type, provided with large knife-edge bearings, giving practically indefinite life. An independent arc shield and powerful magnetic blow-out are fitted to each contactor, ensuring quick interruption of heavy overloads without damage to the contacts. The contacts themselves are ¾ in. wide, rated for 100 to 150 A and are standard throughout the controller, while the flexible braid connections are double, thus increasing the flexibility and life of the braid, and providing ample carrying capacity for the severest overload. In fact, one braid is sufficient capacity to carry the normal operating current of the motor.

With the exception of the foot pedal, which has a phosphor-bronze bearing no less than 2 in. long, the moving parts (namely, the camshaft and the contactor rollers) are provided with ball bearings of ample capacity. The camshaft is turned from square steel bar, and is "Micabak" insulated, the cams being clamped to the square bar.

Regulating Resistance for Battery Charging

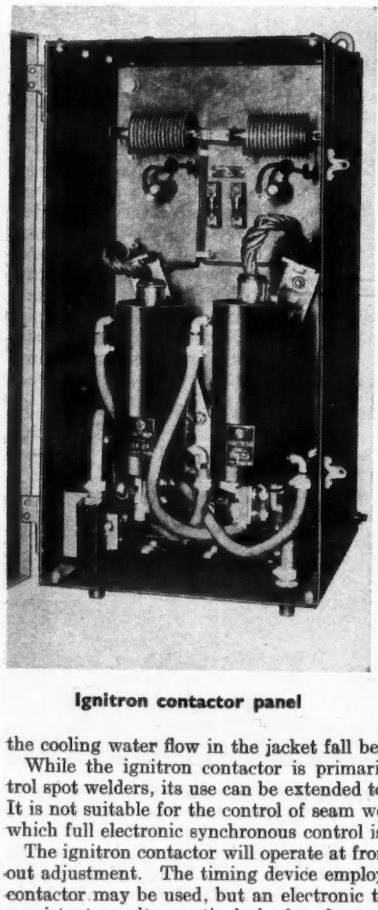
A regulating resistance which has been specially designed for battery charging and similar use is announced by RUNBAKEN ELECTRICAL PRODUCTS, 13-15, Liverpool Road, Deansgate, Manchester, 3. Any size can be supplied to suit individual requirements and operation can be by means of either a lever or a rotary control. When in its extreme left position, the resistance also acts as a switch.



Runbaken regulating resistance

Welding Machine Control

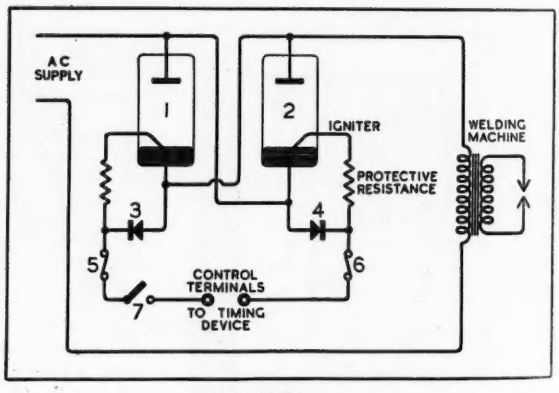
AN ignitron contactor constituting a high-capacity electronic switch introduced by the British Thomson-Houston Co., Ltd., Rugby, comprises two type "BK 24" ignitrons connected reversely in parallel together with their igniter control circuits. The ignitron consists of a permanently sealed evacuated steel cylinder, at the bottom of which is an integral cathode lug. The anode is carried on an insulating glass seal at the top of the tube, and the igniter is supported from a glass insert in the bottom. Ignition is effected by passing a momentary current through the igniter element, the conical tip of which is permanently immersed in a mercury pool; the anode, being then positive to the pool cathode, passes current when ionisation takes place at the igniter. A water-flow switch prevents operation should the cooling water flow in the jacket fall below 1½ gal. per min.



Ignitron contactor panel

While the ignitron contactor is primarily intended to control spot welders, its use can be extended to projection welders. It is not suitable for the control of seam welding machines, for which full electronic synchronous control is necessary.

The ignitron contactor will operate at from 200 to 550-V without adjustment. The timing device employed with a magnetic contactor may be used, but an electronic timer gives the most consistent results, particularly for short welding times. The contactor (type FW 224A1) is connected between one of the AC supply lines and the primary of the welder transformer. Each igniter and its protective resistance is shunted by a metal rectifier in order to limit the reverse current. When the circuit is closed between the control terminals, current passes from the anode of ignitron 1 in the diagram (which is assumed to be positive to its cathode) to the cathode of ignitron 2. Here the greater proportion of the current flows through metal rectifier 4 in a forward direction, while a smaller current flows through the igniter of ignitron 2 as reverse current; the circuit continues through the 5-A fuse 6 to the timing device, water-flow switch 7, and fuse 5, when the current again divides; the metal rectifier 3 passes a small reverse current, but the greater current will flow through the igniter of ignitron 1 to the pool cathode, and thence through the load back to the mains.



Circuit diagram

Its igniter having received a heavy current impulse, ignitron 1 fires. When load current ceases to flow through ignitron 1 it is extinguished and at this instant, due to the inductive load, an appreciable positive voltage is present on the anode of ignitron 2; ignition of this tube follows in a similar manner. Conduction of the two ignitron tubes alternately continues until the control circuit is broken.

Since a voltage must exist across the igniter circuit in order to cause the flow of ignitron current, ignition cannot take place near the zero voltage point at which current transients in the power circuit are most damaging.

COMMERCIAL and INDUSTRIAL NEWS

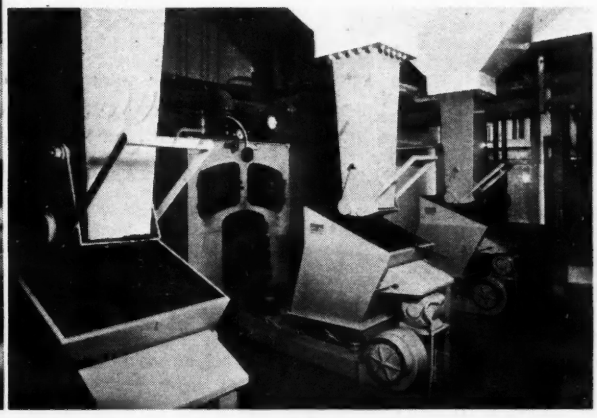
Electric Installation at Doulton House. World's Nickel Consumption. Uruguayan Electrical Trade. New Import Restrictions. War Work for Small Firms.

Doulton House

IMPOSING new premises have recently been completed for Messrs. Doulton near Lambeth Bridge. As far as the productive side of the company's activities is concerned, only certain very specialised work is still carried out at Lambeth to-day. Extension of business and modernisation of production methods have resulted in the transfer of practically the whole of the heavier industrial manufactures to the company's various potteries situated in the Midlands and in Kent. Doulton House consists of three buildings, viz., the main office building, the memorial hall and the Doulton Institute. The main building is heated by an accelerated hot-water system and vectairs, hot-water services being provided by two calorifiers. Three thermostatically controlled boilers are automatically fed by electrically driven stokers. An instrument panel, recording flow and return temperatures and CO_2 content, incorporates all the motor starters and controls. A plenum plant is installed to ventilate the basement units, the kitchen on the sixth floor being independently ventilated.

The electrical installation is controlled by oil-immersed draw-out circuit breakers, mounted on one panel, complete with all meters. Connected to this panel is a 50 yd. run of Henley 3-core 0.2 sq. in. and one core 0.1 sq. in. cable for lighting, and a 50 yd. run of Henley 3-core 0.1 sq. in. and one core 0.06 sq. in. cable for power; both cables are paper insulated, lead covered, single wire armoured left bright, drained, and of the 1,000 V class. These are run as rising mains up to the sixth floor. In cupboards on each floor are link fuseboards for both lighting and power together with phase selectors. Low voltage electric wiring throughout is installed in a three-way metal under-floor duct system, enabling lighting, power, telephone and bell points to be tapped at 3 ft. intervals in any room. About 20,000 yd. of Henley v.i.r. cable were used for the various circuits, including connections to the electric clocks, motors, &c. Two lifts serve the various floors. Secondary lighting at 100 V is provided which automatically comes into operation in the event of a failure of the normal supply. The batteries and equipment are installed in a separate room adjacent to the main switchgear. The building is equipped with an internal automatic telephone system, electric bells and buzzers in addition to visual signals.

The memorial hall, which stands at the rear of the main building, is used principally for staff social activities, and it is wired for loudspeaker, public address and "talkie" apparatus. Stage and auditorium lighting controlled by a dimmer board with three-colour control on floats, battens and ground rows, and provision for spot lights are also among the facilities available in this hall. The wiring in this building was carried out with Henley rubber insulated, taped and braided cable. The Institute building links the memorial hall to the rear of the showroom wing of the main building and affords facilities for the social activities of the members. The electrical installation for the main building was carried out by Troughton and Young, Ltd., and for the memorial hall by the Bective Electrical Co., Ltd.



The new premises of Royal Doulton Potteries showing (left) the entrance hall and gallery and (right) the automatic stokers in the boiler house

Concert at Erith Showrooms

"The Anti-Dims" A.R.P. Concert Party gave a performance at the Erith Electricity Showrooms on March 7th to a crowded house. The concert opened with the illumination of the "Anti-Dims" fluorescent sign executed and presented by Mr. A. A. Neale, of Siemens Bros. Mr. R. Giles, the producer, is connected with the same company, whose subsidiary, Siemens Electric Lamps & Supplies, Ltd., lent the ultra-violet-raw equipment for the fluorescent sign. Thanks were expressed to Mr. E. A. Logan, the Erith electrical engineer, for the excellent lighting arrangements, and to the borough A.R.P. officer, Mr. K. F. Day, under whose direction the "Anti-Dims" appear.

Ediswan Fluorescent Lamp Reflector

The Edison Swan Electric Co., Ltd., has designed a general-purpose trough reflector for the new "Royal Ediswan" 80-W fluorescent discharge tube. The reflector, which is intended for industrial and commercial use, can be used for both local and general lighting. An angular adjustment makes the trough particularly useful for installations where obliquely directed light is required. The unit consists of a sheet-metal reflector and wiring channel mounted between cast end plates. The control gear for the lamp is housed in a sheet metal container box, which is provided with a detachable cover at the side. The reflector is attached to this box by means of angle brackets, and these, by means of wing nutted hinges, provide angular adjustment. A malleable iron socket tapped for 1-in. conduit is fitted at the top of the container box for suspension and cable entry. The whole is finished white glossy synthetic stoved enamel inside and out, and is supplied fully wired to the two terminals for the supply leads.

World's Nickel Consumption

In the report of the International Nickel Co. of Canada, Ltd., Mr. Robert C. Stanley (chairman and president) states that the world's nickel consumption increased in 1939 and attained a new peak estimated to be 256 million lb., as compared with 204 million lb. in 1938 and 240 million lb. in 1937. The company's nickel sales in all forms in 1939 were 210.2 million lb., a new high record and an increase of 45.8 million lb. The increase in nickel consumption over that of 1938 occurred largely in United States markets, although there were substantial increases in British Empire countries. The total volume of deliveries in European and other markets held steadily at about the 1938 figure. Except for differences resulting from currency exchange fluctuations, prices of primary nickel products were at the levels of preceding years.

The company's copper sales in 1939 reached a new high record of 324.8 million lb., against 292.1 million lb. in 1938. Mr. Stanley states that the company, in common with other Canadian copper producers, after the beginning of war entered into a contract with the Ministry of Supply for the delivery of a substantial tonnage of copper, in consequence of which its entire production will be required for delivery in the United

Kingdom and Canada. The world consumption and production of the platinum group metals (platinum, palladium, iridium, rhodium, and ruthenium) are estimated to have been substantially in balance at about 500,000 oz., representing an increase of 40,000 oz. over 1938. The company's sales of these metals were 240,778 oz., a new high record, against 193,195 oz. in 1938.

Lighting in a Nut and Bolt Factory

When the firm of Charles Richards & Sons, Darlaston, was founded in 1870, nuts and bolts were made by the method called the "Oliver," and produced entirely by manual labour through a treadle. At this time the firm employed 70 or 80 hands and possessed only two bolt-making machines. By 1914 the number of employees had increased to several hundred, and it was then decided to scrap the obsolete gas lighting installation for electricity. Since those days the firm has grown to well over a thousand employees making all types and sizes of nuts and bolts. Many additions and improvements have of necessity been carried out in the lighting, but twelve months ago the management decided to have a complete lighting survey of the entire factory by "Metrovick"

"Metrovick" mercury electric-discharge lighting in the general shop at the works of Charles Richards and Sons, Ltd.

illuminating engineers. As a result of this survey it was arranged to replace the multiplicity of local lighting units over the machines by a general lighting scheme by mercury electric-discharge lamps.

Considerable care was necessary in the layout to eliminate shadows from overhead belting and the change-over has been found a great improvement. The general standard of illumination averages 10-12 ft. candles, and in special sections it is 20-25 ft. candles. Up to the present about a hundred 125-, 250- and 400-W mercury electric-discharge units have been installed, but a considerable part of the work still remains to be converted.

In addition to general lighting, Metropolitan-Vickers have been responsible for an interesting A.R.P. lighting installation. In each of thirty shelters is installed an automatic set consisting of a metal rectifier, fed from the mains, which can light the lamps through a transformer. When the mains voltage is cut off the load is automatically transferred to an alkaline battery mounted in the set. This battery is capable of maintaining the full lighting in the shelter for six hours, or half light for twelve hours. In this particular case the lamps in the shelter are 6V, but larger sets and batteries for 12 or 24 V can also be supplied. Although the first cost of this arrangement is rather high, there are no maintenance charges, whereas if duplicate sets of batteries are used they must be regularly charged, particularly if an acid battery is used.

Ex-Siemens Men

The Association of Ex-Siemens Men is holding a smoking concert on March 29th at the Bedford Corner Hotel, Tottenham Court Road, W. Mr. P. C. Pope, the treasurer, 30, Bramham Gardens, S.W.5, or Mr. R. R. Griffin, the secretary, c/o the Union Cable Co., Ltd., Dagenham Dock, Essex, will be pleased to forward particulars of the Association to any who are qualified for membership.

Falmouth Schoolgirls Learn to Cook

A number of the girls at Falmouth County High School are taking housecraft as a subject in the school certificate examination, and about thirty of them recently received a valuable afternoon's instruction in the principles and practice of cooking by electricity at the showroom of the Electricity Supply Corporation, Ltd. Miss B. M. Tucker, the company's demonstrator, gave a lucid account of the technique and economies of cooking by electricity, illustrated by practical use of the oven, grill, and boiling plates.

The A.S.E.E. Wiring Rules Guide

We are asked by the Association of Supervising Electrical Engineers to mention that the charges of 1s. 3d. paper and 1s. 9d. cloth made for its employees' guide to the eleventh edition of the I.E.E. Wiring Regulations do not include postage, for which another 3d. should be sent.

Stereo Plate Casting

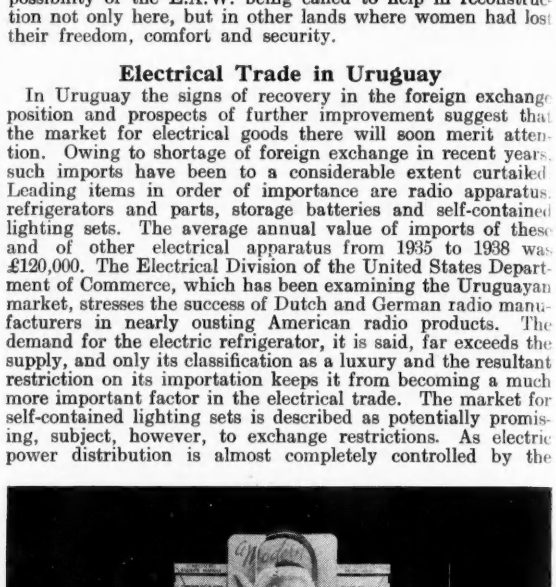
In the article under the above heading in our issue of March 8th, 1940, a reference to the installation of Allied Newspapers, Ltd., reads: " . . . the control panels which, with the switchgear, were built to Barlow-Whitney's requirements by Erskine Heap & Co., Ltd." We believe the word "requirements" may have been read as meaning design, which is not so, and in any case we wish to make it clear that the switchgear at Withy Grove was designed and manufactured for, and supplied to, Allied Newspapers, Ltd., by Erskine Heap & Co., Ltd.

E.A.W. (Bristol Branch)

The eleventh annual meeting of the Bristol and District Branch of the E.A.W. was held at the Berkeley Café, Bristol, on March 12th, Lady Apsley presiding. Miss C. Haslett, C.B.E., gave an address, in which she referred to the national work being done by the eighty-seven branches of the E.A.W. She described the ideal kitchen at headquarters, and said that one of the most important pieces of work they had to do was in helping the nation on the question of food; they had to think of it from two angles, one to help shipping and get accustomed to using substitutes, and the other to keep the food as nutritious as possible. Miss Haslett spoke of the possibility of the E.A.W. being called to help in reconstruction not only here, but in other lands where women had lost their freedom, comfort and security.

Electrical Trade in Uruguay

In Uruguay the signs of recovery in the foreign exchange position and prospects of further improvement suggest that the market for electrical goods there will soon merit attention. Owing to shortage of foreign exchange in recent years such imports have been to a considerable extent curtailed. Leading items in order of importance are radio apparatus, refrigerators and parts, storage batteries and self-contained lighting sets. The average annual value of imports of these and of other electrical apparatus from 1935 to 1938 was £120,000. The Electrical Division of the United States Department of Commerce, which has been examining the Uruguayan market, stresses the success of Dutch and German radio manufacturers in nearly ousting American radio products. The demand for the electric refrigerator, it is said, far exceeds the supply, and only its classification as a luxury and the resultant restriction on its importation keeps it from becoming a much more important factor in the electrical trade. The market for self-contained lighting sets is described as potentially promising, subject, however, to exchange restrictions. As electric power distribution is almost completely controlled by the



An effective display of its new streamlined kettles in one of the windows of the headquarters of the G.E.C. at Magnet House, Kingsway, W.C.2

Government, the market for power plant must be approached through the department concerned. Imports of wire and cable used to come chiefly from Germany, and meters, switches and lamps also from Europe, as American prices were generally found to be too high.

Laxton's Builders' Price Book

The 1940 edition of "Laxton's Builders' Price Book" has just been published (Kelly's Directories, Ltd., 10s. 6d. net, post free). The value of this publication is that it combines under one cover a great deal of information which could otherwise only be obtained from a variety of sources, and enables comparison to be made between alternative materials and methods of construction. By means of the various analyses and other data the prices can be adjusted to suit different localities and conditions. A feature of this edition is an A.R.P. section, which gives prices for temporary, semi-permanent and permanent shelters of various types, together with descriptions and prices of fire-resisting and fire-proofing materials, gas and splinter-resisting windows, shutters and doors, gas filtration and ventilation plants and sundry fittings. The blue pages will be found useful to those who require the names and addresses or telephone numbers of the makers of proprietary articles and building products sold under trade names; this section has been revised and extended for this edition. The tables showing the standard rates of wages

for the building trades of nearly 750 towns and districts of England and Wales include those regradings which came into force on February 1st, 1940.

Import Restrictions

The Import of Goods (Prohibition) (No. 8) Order, 1940, which comes into force on March 25th, adds the following goods to those classes which may not be imported without a licence from the Board of Trade:—Accumulators and parts; bell apparatus; radio apparatus (including valves) and parts; insulated wires and cables; connectors, couplings, junction boxes, fuse boxes, and parts. Applications for import licences should be addressed to the Import Licensing Dept., 25, Southampton Buildings, Chancery Lane, W.C.2.

Trolley Bus Contract

A short time ago the Rotherham Corporation placed an order with Sunbeam Commercial Vehicles, Ltd., for a fleet of Sunbeam-B.T.H. six-wheel trolley bus chassis. Another Yorkshire transport authority, the Tees-Side Railless Traction Board, which was one of the earliest undertakings in this country to operate trolley buses, has now placed an order with the Sunbeam Co. Both the Rotherham Corporation and the Tees-Side Board operate trolley buses exclusively of the single-deck type. A big proportion of the vehicles in the Rotherham fleet are six-wheel chassis, the Sunbeam-B.T.H. chassis now under construction for Rotherham being the latest "M.S.2.C." six-wheel design, and the bodies will have seating accommodation for forty passengers.

War Work for Small Firms

At the request of Mr. Leslie Burgin, Minister of Supply, 110 Chambers of Commerce throughout the country are co-operating in the task of bringing the smaller industrial establishments into war production. Mr. R. B. Dunwoody, secretary of the Association of British Chambers of Commerce, has received a letter from the Ministry in which it is stated that it is proposed to examine the offers of capacity of all those firms who wish to be considered for munitions production through the medium of the area advisory committees and the area boards which have been or are being set up.

The area boards consist of representatives of the Admiralty, Air Ministry, Ministry of Labour and National Service and the Ministry of Supply, and it is possible that representatives of the Board of Trade will be added in the interests of export trade. The boards are advised by area advisory committees, which are composed of representatives of the Engineering Employers' Federation and the Trade Union Congress General Council. The committees have been supplied with details of various stores for which additional manufacturing capacity is needed and which it is thought the smaller firms could make.

Surrey Wholesale Electrical Co.

In our March 8th issue (p. 289) there appeared a note mentioning a meeting called to hear an account of the winding-up of the Surrey Wholesale Electrical Co. We are asked to explain that this liquidation was a purely formal one to permit the amalgamation of the company with Alliance Wholesale, Ltd., to form the Alliance & Surrey Wholesale, Ltd., 62, Great Russell Street, W.C.1, as from July 1st, 1938. All the Surrey Wholesale Co.'s debts have been paid in the normal course of trading by the amalgamated concern and all shareholders have been fully provided for.

Irish Electrical Traders and Building Slump

The Executive Council of the Society of Electrical Traders of Eire, at a meeting in Dublin recently, adopted a resolution drawing the attention of the Government to the grave situation which faces the electrical trade by reason of the slump in the building industry. The Society trusts, continues the resolution, that the plans outlined by representatives of the building industry to the Prime Minister, Mr. de Valera, will be proceeded with at the earliest possible date.

Special Motor Manufacture

Increasing demands for special electric motors have recently necessitated a further increase in the factory accommodation of the Croydon Engineering Co., Ltd., in Commerce Way, Croydon. The new section, which adds about one-third more floor space to the 13,000 sq. ft. previously available, has permitted a general expansion and rearrangement of all departments, and will no doubt still further increase efficiency. Even now, however, there is a tendency for overcrowding, and Mr. W. H. Ward, the managing director, told us when we visited the works recently that further extensions will be carried out as soon as the builders can undertake the work. Nearly all the ground available—thought ample for many years' development when the company moved to the new site three years ago—has now been built over, so that future extensions will probably have to take the form of an upper floor. The company makes special motors for all manner of purposes, but among the units most in demand are those for telephone and telegraph work, drilling machines, mixers, chemical work, high-speed blowers, laboratory drives, &c.

Installation Data

The utility of a brochure of forty-eight pages prepared by British Insulated Cables, Ltd., is likely to be a good deal more extensive than its name—the "B.I. Pocket Book for Wiremen"—might imply, as anyone in any way connected with installation work is likely to appreciate the value of having essential data in so handy a form. In the arrangement of tabulated matter due consideration is given to the needs of the many engineers who still find it easier to work in terms of SWG and sq. in. of conductor area than of so many strands of given diameters, though the latter receive due prominence in the tables giving weight, resistance, voltage drop, current ratings, conduit capacity and similar details. Notes relating to elementary three-phase formulæ, voltage drop, motor horse-power and installation testing are included, together with the approximate number of amperes taken at various voltages by AC and DC motors. Brief descriptions are also given of the six B.I. wiring systems.

The only criticism that we can make is that in reproducing the fuse table from the I.E.E. Regulations, the word "eutectic" might have been translated into wiremen's (and plain) English. I.E.E. Regulations 403, 404 and 405, covering metal-sheathed t.r.s. and conduit systems, provide useful additional information.

Winding-up Petitions

In the Companies' Court on March 18th Mr. Justice Crossman had before him a petition by the Sun Electrical Co., Ltd., for the compulsory winding-up of Architectural Constructional & Electrical Utilities, Ltd.

Counsel for the petitioners, who were judgment creditors, asked his Lordship to make no order on the petition. Mr. Lewin said he appeared for other creditors for £400, and he asked for his clients to be substituted now as petitioners. Counsel for the company said their view of this claim was that the persons now sought to be substituted were not creditors.

In the result his Lordship directed that the matter should stand over.

On the same day Mr. Justice Crossman made an order for the compulsory winding-up of the Electric Movement & Engineering Co., Ltd. The company did not appear and there was no opposition.

Electrical Imports of Iraq

The value of electrical machinery, etc., imported into Iraq during the first nine months of last year was 186,000 dinars, as compared with 156,000 dinars in the corresponding period of 1938 (Dinar=£1).

Prices of Materials

Henry Gardner & Co., Ltd., report, March 19th: No change in the price of copper bars (best selected), sheet and rod, English pig lead, spelter and mercury. English block tin, £248 5s., £8 15s. decrease.

No changes in the prices of materials were reported on March 19th by Edward Till & Co. (india-rubber, Para fine), and F. Smith & Co. (electrolytic copper bars, wire rods and h.c. wire).

New Catalogues and Lists

British Insulated Cables, Ltd., Prescot, Lancs.—A leaflet on B.I. jointing compounds (P.F.354).

G. Turnock, Ltd., 41, High Street, Aston, Birmingham.—A wholesale and export price list of "Tunion" bakelite accessories.

Benjamin Electric, Ltd., Brantwood Works, Tottenham, London, N.17.—A folder pointing out the necessity for good lighting in factories, especially in wartime.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—Leaflet BC.8974 giving particulars of current-fed microphones for public address.

British Thermostat Co., Ltd., Windmill Road, Sunbury-on-Thames.—A folder introducing the new "Adaptastat" thermostat for the auomatic control of domestic heating apparatus.

M. Taylor, 51, Devonshire Road, London, N.13.—A leaflet describing the "Docolite" lighting fitting for attaching to a dog's collar in the black-out.

L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, London, W.C.2.—Details of the new "Legalite" mercury torch switch which puts out the light when the torch is turned upwards.

Rhodes, Brydon & Youatt, Ltd., Waterloo Engineering Works, Gorsey Mount Street, Stockport.—Publication 728 giving particulars of small vertical sump drainage type "Mopump" units.

Information Department

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

CRAWFORD electric cooker (agents).

Mica-splitting machines to 0.0125-in.

ELECTRICITY SUPPLY

Many Increases in Charges. Tow Law Council Considers Scrapping Gas Plant. Electrical Development in Lithuania

Blackpool.—LIGHTING IN SHELTERS.—The General Purposes Committee is asking the borough electrical engineer to report on the cost of providing electric lighting in all public air-raid shelters.

Bradford.—ECONOMY COMMITTEE'S RECOMMENDATIONS.—Last July a special Economy Committee was given the task of investigating possible economies in various branches of the Corporation's activities, and in January a number of recommendations were made which aimed at preventing "violent" competition between the gas and electricity undertakings (ELECTRICAL REVIEW, January 19th). The matter was referred to the Finance (Estimates) Sub-committee, at a recent meeting of which the replies of the chairmen of the Gas and Electricity Committees were considered. Before making any recommendation to the Council the Sub-committee has referred the replies to the Economy Committee for comment.

Bridgend.—PRICE ADVANCE.—An increase in electricity charges of 12½ per cent. has been authorised.

Burton-on-Trent.—POWER STATION SWITCHGEAR.—The Electricity Committee is to install two feeder switches and modernise switchgear at the power station at an estimated cost of £8,780.

Cheltenham.—SUPPLY TO ESTATE.—The Electricity Committee is to extend the mains to the Oakley Farm estate at a cost of £1,339.

Clitheroe.—ELECTRICITY PROFITS FOR RATES.—The Finance Committee has decided to take £1,000 from the profits of the Electricity Department for the relief of the town rates.

Colchester.—ELECTRICITY FOR PUMPING.—The Town Council has approved a scheme for supplying additional electricity to one of the pumping stations of the South Essex Waterworks Co., and for the erection of a new line for this purpose at an estimated cost of £13,500. It is applying for permission to borrow this amount and consent from the Ministry of Transport for the erection of overhead lines.

Crewe.—INCREASED CHARGES.—At a recent meeting of the Town Council the chairman of the Electricity Supply Committee drew attention to the decision of his Committee to increase tariffs by 2½ per cent. and to reduce the discount for prompt payment of accounts.

Croydon.—LOANS SANCTIONED.—The Electricity Commissioners have sanctioned loans of £1,346 for switchgear, &c., £1,049 for land and a substation building, and £45,119 for electricity mains. Shirley Road substation is to be converted from 2,000 to 6,000 V and additional low-voltage feeders laid at cost of £6,920.

Dorchester.—HOSPITAL HEATING.—The Health Committee has decided to install electric heating in the nurses' quarters and gas heating in the observation block of the hospital.

Eastbourne.—OVERGROUND DISCONNECTING BOXES ALLOWED.—A resolution by the Highways Committee against a scheme put forward by the Electricity Committee for the erection of eleven new overground disconnecting boxes was discussed at a recent meeting of the Town Council, when Councillor Caffyn moved an amendment that the scheme should be approved. For the Highways Committee it was suggested that the boxes might be a source of danger in the black-out, but this was contested, and Councillor Caffyn's amendment was carried.

East Grinstead.—FURTHER PRICE ADVANCE.—A few months ago the Council imposed a 5 per cent. addition to quarterly electricity accounts, and this has now been raised to 10 per cent. For prepayment supplies the charge is being raised from 7d. to 7¼d. per kWh.

Ipswich.—REVISED CHARGES.—Alterations in electricity charges to come into force on April 1st are estimated to produce an increase in revenue during the ensuing year of £15,850. The lighting flat rate will be raised to 5d. per kWh, the present price being 4d. up to 1,000 kWh per quarter and 3d. thereafter. Outside the borough the price will be increased from 5½d. to 6½d. This will provide the bulk of the additional revenue, namely £12,350. The power rate inside the borough is to be advanced from 1¾d. to 2d. For assessments up to £40 the fixed charge under the rateable value tariff is to be increased from 15 to 17½ per cent. and under the domestic tariff (outside the borough) there will be a small amendment. The business contract tariff is to be replaced by a new tariff which is expected to result in a reduction in revenue of £835. Inside the borough the tariff at present comprises a fixed charge of £10 per kW per annum up to 5 kW of lighting demand and £8 per kW thereafter, with a running charge of 0.5d. per kWh. The new rate will be £9 per kW per annum up to 10 kW of lighting demand and £8 per kW thereafter, with a running charge of 0.5d. per kWh for 500 kWh per kVA of maximum demand per quarter and 0.4d. per kWh beyond that amount. Outside the borough there is a corresponding charge.

Keswick.—COUNCIL COMPLAINS OF DELAY.—Complaints of delay in changing over the system of electricity supply in the area and allegations that the Keswick Electric Light Co. had not adhered to its agreement with the Council were made at a recent meeting of the Urban District Council. The Lighting Committee instructed the clerk to write to the Electricity Commissioners regarding the delay, pointing out that the Company had agreed to have the work completed by June 1st, 1939. It was suggested that there were grounds for the Electricity Commissioners to hold an inquiry into the matter.

Lancaster.—SUPPLY EXTENSION.—The Town Council is to extend the electricity supply to Tewitfield.

Liverpool.—ELECTRICITY ESTIMATES.—Estimates of the Electric Power & Lighting Commttee for the year to March 31st, 1941, budget for an income of £2,446,000, against approximately £2,308,300 in the year now closing and a surplus of £43,320 (against £51,000). Generation account for C.E.B shows an estimated income of £1,428,000. It is expected that the income for the year to March 31st, 1940, will be £1,293,980.

London.—ISLINGTON.—The London County Council is recommended to sell Highbury Quadrant to the Borough Council for an electricity substation.

HACKNEY.—It is recommended that the Council should reappoint a Special Domestic Apparatus (Purchasing) Committee for buying such apparatus for hire as may be required from time to time.

Retford.—10 PER CENT. PRICE INCREASE.—The Council has decided to increase its electricity charges by 10 per cent.

Sedgefield (Durham).—STREET LIGHTING PAYMENTS.—It was reported at a meeting of the Rural District Council that as a result of negotiations with the North-Eastern Electric Supply Co., Ltd., the street lighting terms had been revised in view of the black-out. It had been agreed that the charge should be 25 per cent.

Southampton.—NO RATE AID.—In each of the last two years the Electricity Department has given over £12,000 in aid of the rates, but it is not proposed to make any contribution this year. For the present year it is estimated that there will be a net surplus of £150 as compared with the £10,520 originally anticipated. The Committee estimates that there will be a net surplus of £3,410 at the end of the next financial year, and it is not necessary to recommend an increase in charges.

Stoke-on-Trent.—SUPPLY TO SHELTERS.—The city electrical engineer has been authorised to provide electricity services to underground shelter trenches on the same terms as for any ordinary consumer, namely, the cost of the first 60 ft. to be borne by the Electricity Department and any length beyond this to be chargeable.

DISTRIBUTION PROJECTS.—The Electricity Committee is to increase the transformer capacity at three substations in Oakhill, Burslem and Trent Vale at a cost of £1,890. It also proposes to extend the mains from the Oxford Road substation, Newcastle, to Wolstanton Colliery.

Taunton.—SUPPLY EXTENSION.—The Town Council has authorised the Electricity Committee to proceed with the work of extending the supply from Ash Priors to Halse, at a cost of £130.

Tow Law (Durham).—CLOSURE OF GASWORKS CONSIDERED.—At a recent meeting of the Urban District Council it was reported that the Council had a chance of acquiring a second-hand gas holder which could be used in connection with the repairs necessary to its gasworks. Against this the advisability of closing the gasworks altogether and changing over to electricity was considered, a representative of the North-Eastern Electric Supply Co., Ltd., being present. It was eventually decided that the matter should be left in abeyance until information had been obtained from the Company as to the possibility of some concession in price to the town.

Winchester.—HIGHER CHARGES.—The City Council has approved increases in electricity charges as follows: Flat rate lighting charge: city area from 6d. to 7d.; rural district from 7½d. to 8d. "All-in" domestic tariff: an increase in the assessable room charge from 15s. to 18s. per annum. "All-in" business tariff: an increase in the kilowatt charge from £3 5s. to £3 10s. per quarter. Heating flat rate: an increase during the two summer quarters from 1d. to 1¾d. per kWh. The quarterly charges for cookers, water heaters and wash boilers let out on hire are to be increased by 10 per cent. to meet their increased cost.

Walthamstow.—PRICE INCREASE.—At a recent meeting of the Borough Council Alderman W. H. Shaw stated that electricity would cost consumers 15 per cent. more from the end of this month. He said it was estimated that there would be a deficit on the undertaking at the end of the present financial year of £40,000.

Wolverhampton.—PROPOSED PRICE INCREASE MODIFIED.—At a meeting of the Town Council last week it was proposed that the electricity charge to private consumers should be increased by 10 per cent. This was strongly criticised, and it was decided that the advance should be 7½ per cent. Councillor

Dallow said that under the resolution there would be a revenue of £62,000 to meet an extra expenditure of £34,000.

Worthing.—ANOTHER ADVANCE IN CHARGES.—Faced with an estimated deficit of £21,350 in the ensuing financial year the Council has decided to raise the 4 per cent. addition to all charges imposed last year to 15 per cent.

Overseas

Australia.—LONG TRANSMISSION SPAN.—A transmission line constructed by the New South Wales Department of Railways has a span, where it crosses Hawkesbury River from the mainland at Brooklyn to Long Island, of 3,131 ft. between supporting poles, which is said to be one of the longest spans with wooden poles in the world. The conductors are 19/.089 hard drawn cadmium copper erected without joints and anchored at each end. The sag of the conductors below the higher support at a temperature of 70 deg. F. is 347.6 ft., and the tangential tension 2,445 lb. at the higher support and 2,365 at the lower. The poles supporting the span are spaced 30 ft. apart, those on the Brooklyn side being single poles 60 ft. in length, and those on Long Island being composite towers consisting of two 50-ft. poles at the base and an upper pole secured by steel connecting fittings; the total height of the tower above ground is 71 ft. The line according to the *Electrical Engineer and Merchandiser*, will eventually form a part of the interconnecting link between the power stations at White Bay, Sydney, and Zarra street, Newcastle, and will be operated at 66 kV. At present, however, it is being used for supplying, at 33 kV, the power necessary for the construction of the new railway bridge over the Hawkesbury River. The length of the route is 15 miles, and, except for a short distance in the vicinity of Hornsby, it is largely through rocky, precipitous country.

Lithuania.—ELECTRICAL DEVELOPMENT.—Plans for the electrification of the country have for some time been entrusted to the Lithuanian Power Committee, of which Mr. J. Jankevicius, Vice-Minister of Communications, is chairman, reports *Reuter's Trade Service*. The Committee's mandate embraces investigation of the country's land resources, fuel, water power, and electrical economy proper. The section examining the country's water power has already completed a survey of twenty-three of the largest rivers. It is estimated that between 200,000 and 250,000 kW can be obtained from these sources—about 80 per cent. from the Nemunas and Neris. After careful consideration the Power Committee has unanimously decided that construction of the Turniskiai central power station must be continued. With the completion of this plant the proposed extension of the Vilna and Kaunas thermal stations in 1942 would become unnecessary, since the Turniskiai station would supply both Vilna and Kaunas with energy. When electricity from the Turniskiai station becomes available the country will be able to dispense with imported fuel, of which the Vilna and Kaunas stations consume about 43,000 tons a year. Construction of the new station will take three years and will cost about Lt.18,000,000. The price of electricity for Vilna and Kaunas consumers would be halved. Construction of the station will be entrusted to the Elektra Co., of whose capital 96 per cent. has been subscribed by the State.

Palestine.—NEW POWER STATION.—The Dead Sea works of Palestine Potash, Ltd., are to be considerably extended. In connection with this project a large new power station has been planned.

United States.—RECORD OUTPUT.—According to the Federal Power Commission a new record for power production was made in 1939, the preliminary estimate being 180,271 million kWh. This means a gain of 12 per cent. on 1938, and is said to be far in excess of the highest annual total previously reported. Of the total 127,989 million kWh was produced for public supply. Production by water power amounted to 43,995 milion kWh, about 2 per cent. less than in 1938, and representing 34 per cent. of the total output for the year.—*Reuter's Trade Service.*

TRACTION

Australia.—NEW SYDNEY SUBURBAN ELECTRIC LINE.—An extension of the Sydney suburban electric railway system has been completed with the opening to traffic of the Sutherland to Cronulla line, on which there are six stations.

Hungary. — RAILWAY ELECTRIFICATION PROJECT. — The Hungarian State Railways (M.A.V.), which operate practically the whole of the country's railway system, have so far carried through the electrification of only one line, a section of the Budapest-Vienna route from Budapest to Hegyshalom on the Austrian frontier. The length of this line on Hungarian soil is 151 miles. The M.A.V. possesses no power station of its own, the Bánhida station, in the north-west of the country, supplying the electricity required. Although this station is bound to supply electricity at a cheap rate, it cannot be said that electrification of the line has resulted in any material reduction in expenditure compared with steam traction. Nevertheless, the State Railways are planning the electrification of a further line, from Budapest to Miskolc in the north-east. The electric locomotives in Hungary, so far, reach an average speed of only 75 km. per hour, but they are being replaced by new ones of 150 km. per hour.

London.—NEW TUBE STATION.—A contract has been placed with Prestige & Co., Ltd., by the London Passenger Transport Board for buildings and other works at Highgate Station, where a new tube station is to be built 135 ft. below the level of Archway Road. From a new entrance hall escalators will lead down to a ticket hall underneath the existing L.N.E.R. station, and there will be escalators down to the tube platforms. The tube station is expected to be opened in June and the whole work should be completed by December. The station will have five levels.

Newcastle-on-Tyne.—RATE CONTRIBUTION DESPITE DEFICIT.—Discussion as to whether the Transport and Electricity Department should contribute an amount equal to a 2d. rate each year to the general rates took place at a meeting of the City Council when it was decided that the principle of a contribution by the Department should be maintained but a fixed sum was not agreed to. Councillor Rowland said that this year the Department had been asked to pay only a token sum of £5,000 on account of its financial position. It was anomalous to ask them to pay an amount equal to a 2d. rate (about £20,000) next year when the Department's deficit might be greater than the £31,000 this year. He suggested that the proposal should be deleted. Alderman Nixon, supporting the recommendation that the Department should contribute a fixed sum each year, said that this year it had put £61,000 against capital expenditure. If this policy were continued there would never be any surplus. The Department could easily assist the rates. Councillor Pearson said the Department's funds should be used to cheapen fares and not help the general rates, while Alderman Locke said he believed in paying for things out of revenue instead of borrowing.

Reading.—TROLLEY-BUSES PROVE PROFITABLE.—The adoption of trolley-buses by the Corporation transport undertaking has been abundantly vindicated, states the *Passenger Transport Journal* in reporting that the Town Council has announced that the estimated profit for the year is £15,000.

Municipal Supply Undertakings' Results

Town	Engineer	Total Revenue 1937/8	Total Revenue 1938/9	Working Expenses 1937/8	Working Expenses 1938/9	Net Profit or *Loss* (*L*) 1937/8	Net Profit or *Loss* (*L*) 1938/9	Sales of Electricity in Distribution Area 1937/8	Sales of Electricity in Distribution Area 1938/9	Percentage Increase
		£	£	£	£	£	£	Thousands of kWh		
Barking	W. E. Kidner	111,456	121,172	85,614	98,468	9,904	5,900	22,936	26,060	13.6
Bedford	P. G. Campling	250,172	272,043	181,261	200,001	160	2,302	64,040	68,553	7.0
Bexhill	R. C. Carter†	68,734	68,995	45,584	57,900	5,152	*7,158L*	9,170	10,396	13.3
Cardiff	E. Jones	446,094	473,125	307,056	406,016	56,044	*7,504L*	131,232	145,581	10.9
Croydon	F. N. Rendell-Baker	545,700	552,150	344,969	357,944	70,347	42,390	118,958*	110,687	*6.9 decrease*
Ealing	R. Birt	176,813	192,344	119,990	138,663	11,953	7,788	22,620	27,438	21.3
Erith	E. A. Logan	98,160	112,166	77,503	89,917	9,400	5,188	29,184	32,405	9.3
Great Yarmouth	P. E. Rycroft	186,049	192,160	106,789	122,410	24,240	10,403	24,634*	28,742*	16.6
Harrogate	A. Kelso†	160,828	175,178	99,407	107,444	18,430	22,555	23,207	25,514	9.9
Lytham St. Annes	J. C. Fairchild	105,988	108,704	75,022	73,595	*1,856*	551	15,130	16,154	6.8
Morecambe and Heysham	P. Clegg†	70,711	76,011	51,929	45,351	4,484	13,705	13,423	16,369	21.9
Nelson	T. D. Martin	104,513	114,872	71,579	82,752	7,708	5,211	10,607*	11,765*	10.9
Newton-le-Willows	W. Phoenix	33,987	37,034	26,335	28,298	153	697	6,327	6,733	6.4
Norwich	V. A. Pask†	498,477	534,018	360,546	387,562	13,558	27,515	81,570*	89,236*	9.4
South Shields	G. H. Dale†	147,436	150,801	93,596	96,437	8,497	7,924	19,344	20,035	3.6
Stepney	A. E. Campbell	558,308	565,668	368,382	384,275	8,485	9,791	85,385*	87,009*	1.9
Stirling	W. R. Murray	31,116	33,188	25,087	29,013	327	*2,157L*	4,436	4,659	5.0
Warrington	F. V. L. Mathias	243,882	247,341	166,728	176,752	29,351	20,359	57,886	58,325	0.8
Watford	A. W. Barham	242,162	260,211	167,846	174.619	26,938	32,523	61,535*	69,216	12.5

Croydon: * Including 13,986(000) kWh to Southern Railway; now supplied direct from the C.E.B. Bexhill: † Appointed April, 1939. Great Yarmouth: * Excluding bulk supplies to other authorities of 13,452(000) and 12,219(000) kWh respectively. Harrogate: † Appointed September, 1939. Morecambe: † Since appointed to Macclesfield. Nelson: * Excluding bulk supplies to other authorised undertakings of 11,653(000) and 13,428(000) kWh respectively. Norwich: † Since succeeded by Mr. J. A. Sumner. * Excluding bulk supplies of 969(000) and 1,097(000) respectively. South Shields: † Appointed June 16th, 1939. Stepney: * Excluding bulk supplies to Bethnal Green of 19,822(000) and 23,845(000) respectively. Watford: * Excluding 1,168(000) kWh bulk supply to Northmet Co.; this supply ceased in June, 1937.

Previous lists of results were published in the August 18th and November 10th issues of the ELECTRICAL REVIEW.

NEW PATENTS

Electrical Specifications Recently Published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1938

14460. "Television systems and thermionic valve circuits for use therein." I.M.K. Syndicate, Ltd., and P. Nagy. May 14th, 1938. (518210.)

17726. "Electron-discharge tube amplifiers." Marconi's Wireless Telegraph Co., Ltd., and O. E. Keall. June 14th, 1938. (518214.)

20888. "Apparatus for regulating electric arcs." Pathé Cinema Anciens Etablissements Pathé Frères. July 19th, 1937. (518216.)

21325. "Telecinema transmitters." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. July 19th, 1937. (Cognate application 21326/38.) (518311.)

21928. "Electric cables." Cablon, Ltd., and K. S. Wyatt. July 23rd, 1938. (518365.)

23459. "Electric lighting fittings." General Electric Co., Ltd., and S. Hubbold. August 9th, 1938. (518217.)

23786. "Cathode-ray tubes." Ferranti, Ltd., J. L. Miller and H. Wood. August 12th, 1938. (518221.)

24042. "Telegraph apparatus." Autophon Akt. Ges. August 31st, 1937. (Addition to 494000.) (518100.)

24049. "Alternating-current electric switches." Patentvertungs Ges. Hermes. August 13th, 1937. (518102.)

24156. "Systems for controlling the division of load between two or more electric motors." Meech Electric Drives, Ltd., and C. H. Vaughan. August 16th, 1938. (518176.)

24173. "Alternating-current dynamo-electric machines." Patentvertungs Ges. Hermes. August 18th, 1937. (518135.)

24200. "Motor - operated tuning mechanism for radio receivers." E. K. Cole, Ltd., and G. Bradfield. August 17th, 1938. (518229.)

24211. "Electrolytic condensers." S. G. Brown. August 17th, 1938. (Cognate application 34006/38.) (518230.)

24232. "Electric switches, particularly for battery lamps." Platers & Stampers, Ltd. (Edward Katzinger Co.) August 17th, 1938. (518269.)

24245. "Actuating mechanism for electric circuit-controllers." British Thomson-Houston Co., Ltd. August 17th, 1937. (518270.)

24265. "Automatic control systems for arc lamps." F. C. Coates. August 17th, 1938. (518187.)

24278. "Electric motor control systems." C. H. Vidal, and S.E.M. Developments, Ltd. August 17th, 1938. (518366.)

24320. "Means of suppressing electrical interference by sparking-plugs of internal-combustion engines." Belling & Lee, Ltd., A. L. Disney and F. R. W. Strafford. August 18th, 1938. (518273.)

24351. "Electro-magnetically controlled hydraulic reciprocating mechanism." Wadkins, Ltd., J. H. Goddard and W. L. Sims. August 18th, 1938. (518274.)

24354. "Apparatus for manufacturing filaments." British Thomson-Houston Co., Ltd. August 18th, 1937. (517995.)

24362. "Pull-and-push switches." J. Kastl (trading as Castelco Fabrik für Elektrische Apparate und Metallwaren). September 14th, 1937. (518192.)

24453. "Cathode-ray tubes." General Electric Co., Ltd., J. E. B. Jacob and L. C. Jesty. August 19th, 1938. (Cognate application 16955/39.) (518277.)

24463. "Potentiometer circuits for controlling voltages for push-pull photo-cell circuits, thermionic valves and similar purposes." R. C. A. Photophone, Ltd., and J. L. Underhill. August 19th, 1938. (518200.)

24478. "Relaxation-oscillation generators." Standard Telephones & Cables, Ltd., and D. H. Black. August 19th, 1938. (Addition to 485120.) (518240.)

24479. "Teleprinter exchange systems." Standard Telephones & Cables, Ltd., G. C. Hartley and G. A. M. Hyde. August 19th, 1938. (518241.)

24489. "Thermal generation of electric current." H. R. Milnes and L. B. Smith. August 19th, 1938. (518136.)

24561. "Electric motor control systems." British Thomson-Houston Co., Ltd. August 20th, 1937. (518287.)

24595. "Damping devices, particularly for measuring instruments." Fides Ges. für die Verwaltung und Verwertung von Gewerblichen Schutzrechten. August 21st, 1937. (518291.)

24602. "Electric circuits breakers having arc-control devices." A. Reyrolle & Co., Ltd., and R. W. Wild. August 22nd, 1938. (518314.)

24661. "Electric protective systems for electric motors." British Thomson-Houston Co., Ltd. August 20th, 1937. (518370.)

24663. "Phase-changing arrangements." British Thomson-Houston Co., Ltd. August 22nd, 1938. (518000.)

24675. "Electric motors." General Electric Co., Ltd., and H. C. E. Jacoby. August 22nd, 1938. (518315.)

24676. "Electric switches of the dolly-operated type." General Electric Co., Ltd., and C. G. Eden. August 22nd, 1938. (518371.)

24688. "Devices for introducing objects into the evacuated spaces of electron microscopes." Fides Ges. für die Verwaltung und Verwaltung von Gewerblichen Schutzrechten. August 24th, 1937. (518317.)

24727. "Water-cooled high-pressure mercury vapour lamps." R. E. Bentley. August 23rd, 1938. (518377.)

24745. "Thermionic valve circuits." E. L. C. White. August 23rd, 1938. (518378.)

24741. "Socket tubes for electric couplings." Crabtree & Co., Ltd., J. A. McLoughlin and B. G. Harrison. August 23rd, 1938. (518001.)

24785. "Electric cables." Okonite Callender Cable Co., Inc. September 11th, 1937. (518384.)

24800. "Railway track control and indicating panels." Standard Telephones & Cables, Ltd., J. B. Griffiths, A. Brown, N. H. Martin and W. H. M. Hellier. August 23rd, 1938. (Addition to 498143.) (518387.)

24839. "Thermionic valve amplifiers." B. N. Maclarty. August 23rd, 1938. (518390.)

24844. "Electric circuit controllers, particularly electric motor controllers." Igranic Electric Co., Ltd. (Cutler-Hammer, Inc.). August 23rd, 1938. (518391.)

25511. "Methods of insulating electric conductors." British Thomson-Houston Co., Ltd. August 31st, 1937. (518008.)

25701. "Automatic electric alarum to bring attention to the fact that water filling a bath has reached a required level." G. D. Leigh and E. Lieberman. September 2nd, 1938. (518029.)

25743. "Indicator systems for wireless apparatus or the like." Standard Telephones & Cables, Ltd. September 9th, 1937. (518031.)

26079. "Pantograph current-collecting devices for electric railway vehicles." R. Brooks F. Whyman, and Metropolitan-Vickers Electrical Co., Ltd. September 6th, 1938. (518296.)

26162. "Electric motors." British Thomson-Houston Co., Ltd. September 8th, 1937. (518298.)

26163. "Electric-discharge devices." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen). September 7th, 1938. (518299.)

26200. "Electric heating elements." British Thomson-Houston Co., Ltd., and W. J. Sims. September 8th, 1938. (518326.)

26225. "Electric motor control systems." English Electric Co., Ltd., E. A. Binney, H. S. Pound-Corner and H. B. Sedgfield. September 8th, 1938. (518329.)

26246. "Manufacture of high-pressure metal-vapour electric-discharge devices." General Electric Co., Ltd., V. J. Francis and E. Kettlewell. September 8th, 1938. (518331.)

26381. "Carrier-wave signalling systems." Standard Telephones & Cables, Ltd. September 25th, 1937. (518341.)

26482. "Heating by induced alternating-electric current." Electric Furnace Co., Ltd. September 11th, 1937. (518344.)

26814. "Electrical musical instruments." John Compton Organ Co., Ltd., and L. E. A. Bourn. September 14th, 1938. (518041.)

26893. "Systems of control for electrically operated lifts." Express Lift Co., Ltd., and S. T. Hunt. September 15th, 1938. (518044.)

26922. "Rotors of squirrel-cage motors and of salient-pole synchronous machines." Mather & Platt, Ltd., and H. Hopwood. September 15th, 1938. (518045.)

26954. "Devices for controlling the speed of rotation of electric motors." E. Paillard & Cie., Soc. Anon. September 16th, 1937. (518046.)

26956. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. September 17th, 1937. (518047.)

27591. "Automatic electric switching devices." Maschinenfabrik Oerlikon. October 1st, 1937. (518248.)

27726. "Dry surface-contact electric rectifiers." Westinghouse Electric & Manufacturing Co. September 30th, 1937. (518202.)

27731. "Safety-switch mechanism for electric wash-boilers and the like." J. H. Tucker & Co., Ltd., and F. C. Fuke. September 23rd, 1938. (Cognate application 36384/38.) (518395.)

27767. "Electric-discharge lamps." General Electric Co., Ltd., J. H. Timmins and R. A. Woodward. September 23rd, 1938. (518204.)

27932. "Dynamo-electric machines." Patentverwertungs-Ges. Hermes. September 25th, 1937. (Cognate applications 27-33/38, 27935/38, 27936/38, 27937-41/38.) (518207.)

27974. "Metal-clad electric switchgear." Switchgear & Cowans, Ltd., and A. Upton. September 26th, 1938. (518298.)

28107. "Manually operatable electric switches." British Thomson-Houston Co., Ltd. (September 29th, 1937.) (518400.)

28232. "Electric motor control systems." British Thomson-Houston Co., Ltd. October 1st, 1937. (518402.)

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2388. "Metallic conduits for electric conductors." J. M. Hollander. January 24th, 1939. (518208.)

4054. "Circuit arrangements comprising a gas-filled incandescent-electrode discharge tube." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 10th, 1938. (518256.)

11281. "Wireless receiving system." E. P. Rudkin. August 11th, 1938. (Divided out of 518128.) (518308.)

Electrolytic Polishing

In the *Nickel Bulletin*, reference is made to recent work on the electrolytic polishing of metals. This process, which is supplementary to mechanical polishing, can be used with ferrous and non-ferrous materials and appears to have particular advantages for producing nickel-chromium corrosion-resisting steel sheets with a high lustre. Tabulated data on methods used with the more important base metals are included.

FINANCIAL SECTION

New Companies. Returns of Capital. Debenture Charges. Bankruptcies and Liquidations. Reports of Electrical Companies. Dividend Announcements. Stocks and Shares

New Companies Registered

Electrical Engineering & Plastics, Ltd.—Private company. Registered March 13th. Capital, £250. Objects: To carry on the business of electrical and mechanical engineers, manufacturers of tools and gauges, manufacturers of plastics and moulded products, &c. Permanent directors: D. G. Rennett (chairman and managing director), Glengarry, Mansfield Road, Papplewick, Notts; and H. G. Rennett, 67, Roseleigh Avenue, Mapperley, Notts.

Glowheat, Ltd. — Private company. Registered in Dublin March 8th. Capital, £1,000. Objects: To carry on the business of engineers, electricians, metal workers, ironmongers, hardware merchants, &c. Directors: A. McDonald, "Mountain View," Howth Road, Raheny, Co. Dublin; and T. Walsh, 12, Shandon Park, Phibsboro, Dublin.

Electrical & Scientific Developments, Ltd. — Private company. Registered March 12th. Capital, £1,000. Objects: To carry on the business of electrical, mechanical, lighting and general engineers, glassworkers, signal engineers, wire drawers, manufacturers of and dealers in optical and surgical instruments, illuminated signs, lamps, &c. Directors: Dr. V. Planer, 91, Stafford Court, Kensington High Street, W.8; Dr. A. H. Juer, 42, Arkwright Road, N.W.3; and S. L. M. Barlow, 47, Woodbury Drive, Sutton, Surrey. Secretary: A. Juer. Registered office: 10, St. George Street, Hanover Square, W.1.

Companies' Returns

Statements of Capital

India Rubber, Gutta Percha and Telegraph Works Co., Ltd. — Capital £1,250,000 in 250,000 5½ per cent. preference, 150,000 preferred ordinary, 100,000 ordinary and 750,000 unclassified shares, all of £1. Return dated December 26th, 1939. All the preference, preferred ordinary and ordinary shares taken up. £500,000 paid. Mortgages and charges, £366,900.

G. A. Nicholas, Ltd.—Capital, £2,000 in £1 shares. Return dated November 11th, 1939. 1,450 shares taken up. £1,450 paid. Mortgages and charges, nil.

Burma Electric Supply Co., Ltd.—Capital, £270,000 in 150,000 preference and 120,000 ordinary shares of £1. Return dated January 12th, 1940. 120,000 preference and 120,000 ordinary shares taken up. £100,000 paid on 100,000 preference shares. £140,000 considered as paid on 20,000 preference and 120,000 ordinary shares. Mortgages and charges, nil.

Cable Research, Ltd.—Capital, £5 in 100 shares of 1s. Return dated December 31st, 1939. Two shares taken up. 2s. paid. Mortgages and charges nil.

Egyptian Power Syndicate, Ltd.—Capital, £10,000 in £1 shares. Return dated January 12th, 1940. Two shares taken up. £2 paid. Mortgages and charges, nil.

Wilson & Ridley, Ltd.—Capital, £1,000 in £1 shares. Return dated November 28th, 1939. 541 shares taken up. £26 paid. £515 considered as paid. Mortgages and charges, nil.

Zenith Electric Co., Ltd.—Capital, £26,250 in 25,000 ordinary shares of £1 and 25,000 deferred shares of 1s. Return dated December 26th, 1939. 25,000 ordinary and 23,334 deferred shares taken up. £5,563 paid on 5,563 ordinary shares. £20,603 14s. considered as paid on 19,437 ordinary and 23,334 deferred shares. Mortgages and charges, nil.

Consolidated Electrical Supplies, Ltd.—Capital, £100,000 in £1 shares. Return dated December 29th, 1939. Three shares taken up. £3 paid. Mortgages and charges, nil.

Homefyre, Ltd.—Capital, £4,000 in 3,500 preference shares of £1 and 2,000 ordinary shares of 5s. Return dated December 31st, 1939. 1,600 preference and 2,000 ordinary shares taken up. £2,100 paid. Mortgages and charges, £1,300 debentures.

Receivers Released

Celtic Electrical Products, Ltd.—Percy A. Hayes, of 12, Pembroke Terrace, Cardiff, ceased to act as receiver on February 27th, 1940.

Robinson & Hands Electric Co., Ltd.—Harold V. L. Heaven, of Waterloo House, 20, Waterloo Street, Birmingham, ceased to act as receiver and/or manager on March 2nd, 1940.

Company Liquidations

Oxford Broadcasting Relay, Ltd.—Winding up voluntariiy. Liquidator, Mr. L. C. W. Phillips, 8, King Edward Street, Oxford.

Traffics Radio Syndicate, Ltd.—Meetings April 19th at Merthyr House, James Street, Cardiff, to receive accounts of the winding up from the liquidator, Mr. J. Pearson-Griffiths.

Bankruptcy Proceedings

E. N. Bolsten, electrical contractor, 245, Highlers Heath Lane, Warstock, Birmingham.—Receiving order made March 7th on debtor's own petition.

R. H. Freestone, foreman electrician, 5, Sutton Avenue, Colburn Lane, Catterick Camp.—Receiving order made March 7th on debtor's own petition. First meeting held March 21st. Public examination April 15th at the New Court House, Racecourse Lane, Northallerton.

G. E. Holden, wireless and radio dealer, 39, Heath Road, Twickenham.—Trustee, Mr. C. Latham, 185-188, High Holborn, London, W.C.1, appointed March 5th.

R. Downes, electrical contractor, 40, Brazennose Street, Manchester.—Receiving order made March 11th on debtor's own petition.

E. A. V. Burton, electrical engineer, 14, St. Peter's Park Road, Broadstairs.—Application for discharge to be heard on April 9th at the Guildhall, Canterbury.

Reports and Dividends

The County of London Electric Supply Co., Ltd.—Presiding at the annual meeting held on Tuesday last Sir Robert Renwick, chairman, said that owing to a material decrease in the sales of electricity to the Central Electricity Board their output for 1939 was practically the same as for the previous year, although an extra 85 million kWh, an increase over sales in 1938 of 6½ per cent., was supplied to their consumers. The increase for the first eight months of the year under review was actually 14½ per cent. It was regretted that owing to the cost of raw materials they had had to raise their prices to consumers as from January 1st. Their Barking station, with an installed capacity of 537,500 kW, had given satisfactory service throughout the year, and prior to the outbreak of war they carried out important constructional works to their main transmission system and extended and reinforced their distribution network to meet the growth in load then being experienced. Over ninety-three miles of high-voltage mains were laid down and over 246 miles of low-voltage and medium-voltage mains, while 100 new transforming stations were added. With regard to the future, the war would inevitably retard their progress, but there were, however, certain points of advantage in that their large area contained such a diversity of demand that they might in the long run be less seriously affected than some other public utility concerns. They were alive to the possibility of new outlets for their activities, and their sales of apparatus for domestic purposes alone were three times as great in January this year as in December last.

The Electrical Distribution of Yorkshire, Ltd., held its annual meeting on March 18th, when Mr. R. W. Wickham (chairman) who presided, said that during the first eight months of the year under review the sales grew at a greater rate than ever before, but during the last four months war restrictions brought about an immediate suspension of the normal growth. Nevertheless, taking the year as a whole, they sold nearly 6 per cent. more electricity than in 1938. Street lighting had been prohibited, but a limited standard of street lighting was now permitted and would, they hoped, be generally adopted so as to reduce the dangers and difficulties of darkened streets. There had been some saving of electricity, the benefit of which they had been glad to offer to street lighting authorities in reduction of the normal charges. Many municipal and company undertakings had already been compelled to increase their charges, but so far they had been able by the exercise of great economy, to continue pre-war prices.

Their partnership with the Power Co. in Electricity House, Ltd., was making great progress. Electricity House, Ltd., had now established 17 shops, and was acting for all their associated supply companies. Despite the outbreak of war, the number of new consumers added during the year was little short of that of recent years. In nine years the number of their consumers had been increased threefold. Mr. W. B. Woodhouse (managing director), said that they appreciated the encouragement received from local authorities owning large housing estates, who, in all parts of their area, were now obviously decided on the tenants having not only electric light, but other electrical facilities and were wiring the houses accordingly. They were now supplying electricity to 20,000 such houses on different estates where the tenants were using electricity for a great variety of domestic purposes.

The British Power & Light Corporation, Ltd., held its annual meeting on March 15th when Mr. R. S. Hilton, who presided, said that in North Wales their hydro-electric generating stations had been in continuous operation throughout the year, and although the aggregate rainfall was 10 per cent. less than in the previous year, the combined output from the generating stations was within 1 per cent. of the output obtained in 1938. These results had been achieved largely by the increased operating efficiency at Dolgarrog brought about by the extensions and modifications of the pipe-line system completed in the later months of 1938. Nearly 6,000 new consumers had been added by their subsidiary companies, bringing the total number of consumers connected to over 82,000 at the end of the year.

It was perhaps too early to draw any useful conclusions as to effect of the war on their business. Adverse effects were particularly reflected in the reduced requirements of the quarrying industry in North Wales, and there were indications that many coastal resorts suffered from wartime restrictions. While progress was naturally slowed down, the results for the last quarter of 1939 made a not unsatisfactory comparison with those for the last quarter of 1938. No doubt the full effect of war conditions had not yet been felt and the position would be examined from time to time with a view to putting into effect such modifications of tariffs as appeared necessary and justified. There were, however, several compensating factors already at work arising from the intensive rearmament programme and evacuation arrangements. New developments had been reduced to a minimum since the outbreak of war. Their normal programme was carried out up to that date and during the year approximately 210 miles of new transmission and distribution mains were completed. These developments included extensions to 34 additional villages in the areas of their subsidiary companies, and the con-

struction in North Wales of a new main double-circuit 132-kV transmission line to provide an additional channel of interconnection between the national grid and the load centre of the power company's system.

The Telegraph Construction & Maintenance Co., Ltd., held its annual meeting on Tuesday last when Mr. Colin F. Campbell (chairman), who presided, said that for several years there had been a revival in the demand for submarine cable and, consequently, for gutta-percha, and their subsidiary, the Selborne Plantation Co., Ltd., had, because of this, become a very valuable asset. The year under review had on the whole been satisfactory, and although the total of the orders executed had been slightly less than in 1938, due to a decrease in orders for power cable, especially marked since the outbreak of war, the profit had increased owing to more economical working.

The work in the metal branch had expanded to a great extent, and a further expenditure on buildings and plant had been sanctioned. The demand for radio relay cables was improving, and while there was a temporary fading out in the call for television cables there was a big increase in that for high-frequency cables. In the sales branch opened in connection with their gutta-percha sundries there had been a 40 per cent. increase over and above the 50 per cent. increase in 1938, while the submarine cables branch, jointly owned with Siemens Bros., had been working to full capacity, and they had received orders from Cable & Wireless, Ltd., the Post Office and other Government Departments.

The meeting was followed by an extraordinary meeting at which resolutions were passed capitalising £18,675 of undivided profit, to be distributed as a 5 per cent. bonus share issue, and authorising the issue of a further 62,250 shares of £1 at £1 10s. per share payable in full on allotment, to be offered to existing shareholders in the proportion of one new share for each six shares held.

The Midland Electric Manufacturing Co., Ltd., held its annual meeting on March 13th when Sir C. Herbert Smith (chairman), who presided, said that the company's main business was the specialised production of electrical switch fuse and motor control gear. Up to the outbreak of war the company was fully occupied in meeting a demand for the whole of its range of products, these having been extended by the addition of a range of high-efficiency electric fires. This new production had met with a good reception. War conditions led to a considerable increase in the demand for their industrial products, and this increase had more than compensated for the decline since the outbreak of war in the demand for some of their other products.

During the past year considerable reorganisation of their overseas marketing arrangements had been carried out, and it was gratifying to be able to report that the export sales for 1939 constituted a record in the history of the business. New and improved products would be introduced to the market during the coming months. Extensions were to be carried out at the works during the current year in order to facilitate production of their growing range of products and enable the requisite increased stocks to be carried. Premises had recently been secured in London to accommodate showrooms and stores for the purpose of providing additional service to customers.

The British Thomson-Houston Co., Ltd.—The accounts for 1939 now published confirm the preliminary figures given in our last issue. The balance, after deducting all expenses and charges, other than debenture and loan interest, is £1,038,046, as compared with £970,644 for 1938, and after deducting debenture and loan interest, depreciation, and providing for taxation, a sum of £268,479 is available which, with £182,829 brought in makes £451,308. The ordinary dividend for the year is maintained at 7 per cent., general reserve receives £100,000, and £192,058 is carried forward. The report states that the volume of orders received and the output from the works during 1939 were both greater than for the previous year, and the value of unexecuted orders on hand at the end of the year was greater than at the end of the previous year. Redemption has been duly effected of the amount of 5 per cent. debenture stock required in the trust deed.

Hongkong Tramways, Ltd., reports a profit for 1939 of $1,426,278 ($1= 1s. 2 1/32d.), to which is added $99,484 brought in, making $1,525,762. General reserve receives $400,000, and $22,500 is written off investments. A final dividend of $1 per share is paid, making, with the interim of 50 cents., 30 per cent. for the year, and the balance carried forward is $128,262.

The Newcastle and District Electric Lighting Co., Ltd.—Presiding at the annual meeting held on March 15th Col. Sir Frank R. Simpson, Bt., said that receipts compared with 1938 were down by £1,886, representing 1 per cent. of the total. A reduction in charges to shop tariff consumers and prepayment meter consumers made in April last cost the company £2,900. Arrived at, as it had been, without any increase in charges, he thought the shareholders would agree that the result might be considered satisfactory. The number of new installations connected during the year was 1,362. It would be unwise to indulge in any prophecies regarding results for the coming year, though he might say that the output of kWh during the first two months had given satisfaction.

The British Aluminium Co., Ltd., in a preliminary statement, reports a net profit for 1939 of £647,546, as compared with £607,670 for the preceding year. This figure is arrived at after providing for income tax, N.D.C., and E.P.T., charging the amounts required for service of the debenture stock and setting aside £50,000 to depreciation reserve. General reserve receives £150,000, and with £1,250,000 transferred from share premium account the reserve stands at £2,850,000. The final ordinary dividend is 8½ per cent., again making 12½ per cent. for the year, and the balance carried forward is £176,640 (against £144,094 brought in).

The Greengate and Irwell Rubber Co., Ltd., reports net trading profits of £103,903 for the year to December 24th as compared with £93,650 for the previous year, to which is added £2,915 income from investments, making £106,818. The final ordinary dividend is 1s. 3d. per share, making 2s. 6d. per share for the year (against 2s.), deferred shareholders receive 6d. per share (against nil), and £25,000 is transferred to reserve. The balance carried forward is £41,188 (against £41,620 brought in).

The Clyde Valley Electrical Power Co. reports a balance of profit for 1939 of £627,901, as compared with £574,798 for the preceding year, to which is added £161,314 brought in, making £789,215. A sum of £300,000 is placed to contingency fund, and a final dividend of 5 per cent. is paid on the ordinary stock, making 8 per cent. for the year. This is at the same rate as for 1938, but the £1,050,000 additional capital raised in April, 1938, ranked for the full dividend in 1939. The balance carried forward is £179,215. Extensions at the power stations have proceeded in accordance with programme and the distribution system has been further developed to meet existing and anticipated demands. Sales of electricity to the company's own consumers totalled 529 million kWh, an increase over 1938 of 65 million kWh. The position of the three subsidiary companies —the Lanarkshire Hydro-Electric Power Co., the Strathclyde Electricity Supply Co., Ltd., and Clyde Valley Accessories, Ltd.—is satisfactory. Meeting: April 2nd in Glasgow.

The South Metropolitan Electric Light & Power Co., reports a net revenue for 1939 of £293,104, as compared with £270,798 for 1938. Debenture interest absorbs £56,250, issue expenses £1,625, depreciation £133,152, tax reserve £5,000, contingencies £5,000, and No. 2 reserve £2,500. The final ordinary dividend is £5 13s. 1d. per cent., making £8 13s. 1d. per cent. (against 9 per cent.), and £33,445 is carried forward (against £47,438 brought in).

The Bournemouth and Poole Electricity Supply Co., Ltd., reports a net revenue for 1939 of £173,690, as compared with £174,400 in the preceding year, to which is added £14,848 brought in, making £188,538. After deducting debenture interest and sinking fund contributions, transferring £60,000 to reserve for depreciation, renewals, &c., £10,000, special provision for taxation, and £2,500 for contingencies, there is a balance of £96,382. The final dividend on the ordinary stock is £8 6s. 2d. per cent., making £14 6s. 2d. per cent. for the year (against £15 per cent.), and £14,053 is carried forward. The sales of electricity totalled 72.3 million kWh, an increase of 5.7 million kWh as compared with 1938. The number of consumers increased by 3,891 to 65,380.

The Richmond (Surrey) Electric Light & Power Co., Ltd., reports a net revenue for 1939 of £29,849, as compared with £33,637 for 1938, which with £1,949 brought in makes £31,798. Reserve for depreciation receives £10,000 and the final ordinary dividend is 3 per cent., making 6 per cent. for the year (against 7 per cent.). The balance carried forward is £1,624. The sales of electricity totalled 13,954,902 kWh, a decrease as compared with 1938 of 467,899 kWh.

The South London Electric Supply Corporation, Ltd., reports a net revenue for 1939 of £148,023, as compared with £130,764 for the preceding year. Interest requires £17,285, debenture redemption difference £685, sinking funds £68,415, tax reserve £8,000, contingency reserve £2,000, and No. 2 reserve £19,508. The ordinary dividend for the year is maintained at 7 per cent., and £11,845 is carried forward (against £17,017 brought in). The sales of electricity totalled 69.8 million kWh, an increase of 1,217,593 kWh, and the number of consumers rose by 2,848 to 47,081. Owing to war conditions and to higher costs, increases in rates were introduced from January 1st, 1940.

S. Guiterman & Co., Ltd., reports a net profit for 1939, before taxation, of £23,134, as compared with £19,638 in the previous year. The directors have declared a dividend of 7½ per cent. per annum, less tax, on the ordinary shares for the period from March 15th to December 31st, plus a participating rate of 1 per cent. per annum on the 6½ per cent. cumulative participating redeemable preference shares.

McMichael Radio, Ltd., reports a loss on trading of £1,659 for 1939, which with directors' fees £950, depreciation £3,430, transfer to leasehold redemption fund £250, loss on sale of investments £1,976, and A.R.P. expenditure written off £1,059, makes £9,324. From this is deducted interest £234, transfer fees £9 and income tax adjustment £200, leaving a loss for the year of £8,882. The total debit is £36,350.

The Mersey Railway Co. held its annual general meeting on Tuesday last when Mr. J. Wadell, chairman, who presided, dealt with the terms of Government compensation, and said that the Ministry had agreed to a guaranteed minimum net revenue of £100,015 per annum, equivalent to that of the year ended June 30th, 1939, and that the company should participate in the pool for a proportionate share of any increase in the net revenue beyond the guaranteed minimum. The year under review was the first full year of through working trains and the traffic was developing satisfactorily, although it had been adversely affected by weather and the war.

Brown Brothers, Ltd., report a net profit for the year to January 16th of £84,754, a decrease of £7,312 as compared with the preceding year. The distribution for the year is maintained at 12½ per cent. by the final payment of 10 per cent.

Switchgear & Cowans, Ltd., are paying a first and final dividend of 10 per cent. for 1939 (against 20 per cent. for 1938).

Enfield Rolling Mills, Ltd., is paying a dividend of 3⅛ per cent. in respect of the fifteen months to December 31st. This is the first distribution made since its conversion into a public company in 1932.

Waste Heat & Gas Electrical Generating Stations, Ltd., is paying a final dividend of 5½ per cent., making 8 per cent. for the year (same).

The Watford Electric & Manufacturing Co., is paying a final dividend of 10 per cent., again making 15 per cent. for the year.

Ericsson Telephones, Ltd., has announced a final dividend of 12 per cent., plus a bonus of 7 per cent., making 25 per cent., tax free, for the year (unchanged).

(*Concluded on page* 359.)

STOCKS AND SHARES

TUESDAY EVENING.

THE commencement of dealings in the new three per cent. War Loan was marked by a small but steady stream of sellers under whose pressure to realise their allotments the price went back from its opening figure of ¼ discount to, later on, 10s. discount. On this same day, Monday, the announcement was made that certain prices in the gilt-edged market had been officially fixed as minima; a proceeding which aroused not only surprise, but also a certain amount of uneasiness. It led to prices going back in gilt-edged and other investment issues.

Why this latter step should have been taken is a matter which, for the moment, no one can understand. The uncertainty felt in regard to the political developments on the Continent has added to the causes for dullness in prices. The week before Easter finds the House in a subdued mood.

Tax-free Dividends

Ericsson Telephones have declared a final dividend and bonus, again making a total distribution of 25 per cent., free of tax, for the year—the same as was paid for 1938. In the latter year, with income-tax at 5s. 6d. in the pound, the dividend was equivalent to about 34½ per cent., less tax. This time the dividend is worth practically 38 per cent. gross, subject to tax at 7s. in the pound. In effect, therefore, the maintenance of the dividend at the same net rate means a useful increase in the shareholders' participation. The report has not yet appeared to disclose whether profits have risen to cover the higher cost of the dividend, or whether the distribution is on more liberal lines than before: in 1938 the undistributed surplus would have covered a further 14 per cent. on the dividend. Some people profess a partiality for shares on which dividends are paid tax-free, on the grounds that a company will sometimes feel better disposed to make a higher distribution, in the way that the Ericsson Company is doing, rather than by way of an increase in the actual rate of a dividend subject to tax. The price of the shares, 37s. 6d., has recovered the dividend now deducted.

Electricity Supply in London

London Associated Electricity Undertakings shares are normally quoted in the neighbourhood of 30s. in brighter times than these, which, bringing the evacuation and the black-out, caused expectations of a cut in the normal 7 per cent. dividend and a fall in the price of the shares to about £1. In the event, the reduction of the dividend to 5½ per cent. is certainly no bigger than had been expected. The company controls Central London Electricity—the amalgamation of the old Charing Cross, Brompton and Kensington, Chelsea, Kensington and Knightsbridge and two other undertakings in the middle of London. The dividend paid by this company has been assisted in an appropriation from the reserves. Increased charges decided upon by the Central London were under review last week in Parliament. Higher charges were announced also at last week's annual meeting of the City of London Electric Company.

Other Electricity Reports

Lord Ashfield's review at the Northmet Power Company's annual meeting showed that this undertaking's 1939 experience was similar to that of other metropolitan concerns. An 18 per cent. increase in sales during the first eight months was followed by a 20 to 25 per cent. drop in the war months of the year. It was necessary to take £100,000 from reserves to keep the dividend at 10 per cent. The price of the shares is easier at £2: a line of 5,000 has been on offer at 41s. The full report from Clyde Valley Electrical Power gives all the explanation that may be necessary for the quotation of the Company's shares at a price, 37s. 6d., giving a yield of only 4½ per cent. on the regular 8 per cent. dividend. Results for the year show uninterrupted progress in output and revenues. Earnings comfortably cover the dividend and the usual very substantial allocations to reserves. The system is being further developed to cope with present and future demands. Publication of the complete accounts of Yorkshire Electric and North-Eastern Electric also explain the predilection of investors for the undertakings supplying the industrial areas of the north, and the consequent valuation of the popular provincial shares on a yield basis only ½ to 1 per cent. higher than the return on "old" War Loan.

Electrical Equipment

With investment preoccupied chiefly with the new War Loan, and sentiment influenced by the fresh political considerations, the industrial markets have been left without a great deal of business. Where prices have changed, the move has generally been towards a lower level. Among electrical equipment shares, a little selling of British Insulated Cable shares coincided with the publication of the accounts and lowered the price to 87s. 6d. ex dividend, a price which affords a yield of £4 11s. 4d. per cent. on the 20 per cent. dividend. The distribution is shown to be amply covered by earnings, although these have contracted to a small extent since 1938. Public interest in the results of British Thomson-Houston is confined chiefly to the one-and-a-half million 7 per cent. preference shares, although indirectly, also, to shareholders in Associated Electrical Industries, the controlling company which holds the two million ordinary shares. The Company has to provide over £100,000 more against taxation, but the profit before this change is £67,000 better at just over a million pounds. A conservative dividend of 7 per cent. is paid to the controlling company for the fourth successive year. A line of the well-secured 7 per cent. preference shares is on offer at 32s. 6d. to yield £4 6s. per cent. Associated Electrical Industries shares are a few pence down at 42s. Other price changes in the market this week are declines in Crompton Parkinsons from 20s. to 18s. 9d., Lucas from 60s. to 58s. 9d., and Revo Electrics from 22s. 6d. to 20s. British Aluminium are a trifle easier at 52s. 6d. ex dividend on the announcement of the results, and of a dividend again making 12½ per cent. for the year.

Below Expectations

Markets have had a taste on several occasions of how taxation and other wartime complications can upset calculations. However, in view of the reports of busy conditions in the electrical engineering world, the market—and the prices of the shares concerned—were taken aback to some extent by the halving of the dividend on Switchgear & Cowans 10s. shares, at 10 per cent., and the reduction in the Lancashire Dynamo and Crypto dividend from 25 to 20 per cent. The latter Company, it may be noted, has provided, over the past decade, a number of dividend surprises of the most satisfactory order: the rate was doubled on four occasions between 1932 and 1936, and subsequently increased further from 20 to 25 per cent. Net profits are stated at £130,000 before charging N.D.C. and E.P.T. Net profit for 1938, after taxation, was £143,000. The Switchgear & Cowans report is not yet available: the shares have fallen back to 8s. 9d. Lancashire Dynamo at 55s. ex dividend are 3/16 down, the dividend reduction being larger than was anticipated.

Vickers and Whitehall Investments

Vickers 10s. shares fell by rather less than 1s., to 19s. xd., on the dividend and preliminary figures. The distribution, making 10 per cent. for the year, is the same as for each of the four previous years. According to the figures, the net profit shows a decline of modest proportions, for which, in anticipation of the full report, taxation is assumed to be responsible. Another general supposition is that, Vickers being largely a holding company receiving revenue by way of dividends from subsidiaries, the total earnings of the group are substantially larger than those which appear in the accounts of the parent. The slight setback in the price of the shares is thought to have been due, in the main, to the absence of the capital bonus for which speculation had hoped.

This company has proved the recent supporters of the 7½ per cent. preference shares to have been correct in their expectation that a full year's dividend would be paid, despite last October's decision to pay only 3 per cent. for the first half of the year, instead of the due 3¾ per cent. In the event, the shares remained steady at 17s. xd., showing a yield of £8 16s. 6d. per cent. Interests of the Company are spread between British and overseas electrical enterprises, the latter chiefly in Greece. Buying of the shares, which has raised the price from 15s. over a few weeks, has been based on the belief that progress has been made on both fronts.

Preference and Debenture Stocks

Although the dearth of well secured fixed-interest stocks has not been relieved to any great extent, the supply has become a shade more varied and plentiful. Among the preference shares of electricity supply companies the six per cent. issues of British Power and Light, "City Lights," County of London Electric and Scottish Power can all be bought in the neighbourhood of 29s. to return about 4½ per cent. on the money. Edmundsons and Llanelly Electric six per cents. can be had rather more cheaply, and South Metropolitan "fours" are on offer at just over 20s. Of the debentures available in the same market, North Metropolitan Power Station 3½ per cent. stock is still available free of stamp at 97 xd., and London Power 3½ per cents. at 97½. In each case the running yield is about £3 12s. per cent. Allowing for the profit on redemption in 1965 in the one case and 1972 in the other, the returns equal respectively £3 13s. 6d. per cent. and 1s. per cent. less. Edmundsons 4 per cent. debentures, at 103, pay £3 17s. 6d. per cent., or £3 13s. 9d. per cent. assuming redemption at the earliest date of 1951.

Miscellaneous Matters

Cable and Wireless stocks stand steady while awaiting news as to whether the optimists' expectation of an increase over last year's 4 per cent. ordinary dividend is well founded. Home Railway stocks have been through spells of weakness. Declines of relatively small proportions are general. British Electric Traction deferred lost 50 points to 750, and Tillings are on the dull side at 43s. 3d. Brazilian Tractions reacted to 10¼ after having been 10½ on the Brazilian Government's decision to resume a partial service on its debts. Wall Street still appears unable to make up its mind as to how the war will affect American business, and how the market will be influenced by the requisitioning and sale of British-owned American stocks. Indian electricity supply shares remain in good favour, with Calcuttas 1s. up at 36s. Perak Hydro Electric shares, which follow the tin market, are dull at 17s. 6d. Anglo-Portuguese Telephone has placed a second block of £100,000 5 per cent. debenture at 98¾. Marconi Marines came on offer, and are 1/16 down at 28s. 9d. Fresh falls in London Passenger Transport stocks followed the announcement of materially increased assessment of the Board's properties.

ELECTRICAL COMPANIES' SHARES

Prices, Dividends and Yields

Company	1939 Highest	1939 Lowest	Dividend Previous	Dividend Last	Price March 18	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies							
Bournemouth and Poole ...	68/3	56/-	15	15	62/6	—	4 16 0
British Power and Light ...	30/9	21/-	7	7	28/6	—	4 18 3
City of London	33/9	22/-	7½	7½	26/6	—	5 13 2
Clyde Valley	38/6	26/9	8	8	37/6	—	4 5 5
County of London... ...	46/9	28/-	10½	10½	40/0	−9d.	5 5 0
Edmundson's :							
7% Pref....	31/6	27/6	7	7	30/-	—	4 13 4
Ord.	27/9	18/-	9	6	26/-	−1/-	4 12 4
Elec. Dis. Yorkshire ...	41/6	32/-	9	9	38/3	−6d.	4 14 0
Elec. Fin. and Securities ...	48/3	39/-	12½	12½	40/-	—	6 5 0
Elec. Supply Corporation...	51/9	40/-	12	12	44/-	—	5 9 0
Isle of Thanet	20/-	15/-	4	4	15/6	—	5 3 3
Lancs Light and Power ...	34/6	25/-	7½	7½	32/6	—	4 12 4
Llanelly Elec.	22/6	16/6	5½	5½	21/-	—	5 4 9
Lond. Assoc. Electric ...	30/-	18/-	7	5½	20/-	—	5 10 0
London Electric	34/3	20/-	7	7	27/-	—	5 3 8
London Power Deb. Red....	106½	97	5	5	104½	—	4 15 6
Metropolitan	51/-	32/6	12	10	40/-	—	5 0 0
Midland Counties	39/6	30/-	8	8	37/0	−6d.	4 6 6
Mid. Elec. Power	41/9	33/6	8	9	39/6	+2/-	4 11 2
Newcastle Elec.	28/9	25/-	7	7	28/9	—	4 17 5
North Eastern Electric :							
Ordinary...	32/3	23/6	7	7	30/6	—	4 11 10
7% Pref....	32/6	26/-	7	7	31/-	—	4 10 4
Northampton	48/-	41/-	10	10	42/6	—	4 15 0
Notting Hill 6% Pref. (£10)	13½	10½	6	6	10½	+½	—
Northmet Power :							
Ordinary...	46/6	30/6	10	10	40/0	−⅛	5 0 0
6% Pref....	29/-	23/6	6	6	29/0	+6d.	4 2 9
Richmond Elec.	29/-	21/6	7	7	23/9	—	5 18 0
Scottish Power	38/9	27/6	8	8	36/3	—	4 8 4
Southern Areas	22/9	17/-	5	5	20/6	—	4 17 7
South London	30/9	22/-	7	7	22/6	—	6 4 3
West Devon	23/3	18/-	5	5	18/9	—	5 6 8
West Glos.	21/3	15/-	2	2½	18/9	—	2 13 4
Yorkshire Elec.	38/6	27/9	8	8	38/9	—	4 2 5
Overseas Electricity Companies							
Atlas Elec....	4/3	1/6	Nil	Nil	3/9	—	—
Calcutta Elec.	39/-	25/-	10*	10*	36/-	+1/-	—
Cawnpore Elec.	34/6	27/3	10	10	28/9	—	—
East African Power ...	26/3	20/-	7	7	24/6	—	5 14 3
Jerusalem Elec.	24/6	21/-	7	7	24/-	—	5 16 8
Kalgoorlie (10/-)	10/6	9/-	7½	7	12/6	—	5 12 0
Madras	31/-	21/3	8*	8*	26/3	—	—
Montreal Power	35½	30	1½	1½	33½	—	—
Palestine Elec. " A " ...	27/3	19/6	7½*	5*	25/-	—	4 0 0
Perak Hydro-electric ...	19/6	12/6	6	2½	17/6	−⅛	2 17 4
Shawinigan Power ...	25	20	83cts.	90cts.	23	−½	—
Tokyo Elec. 6%	63	33	6	6	70	—	8 11 6
Victoria Falls Power ...	73/9	60/-	12½	15	74/6	−6d.	4 0 6
Whitehall Investments Pref.	19/6	10/-	7½	7½	17/-xd.	+6d.	8 16 6
Public Boards							
Central Electricity :							
1950–70	112	103	5	5	109	—	4 11 7
1955–75	115½	104½	5	5	111	—	4 10 0
1951–73	106½	101	4½	4½	107	—	4 4 0
1963–93	95½	84	3½	3½	95½	—	3 13 8
London Elec. Trans Gtd....	88½	83	2½	2½	91½	—	2 10 4
London & Home Counties							
1955–75	107½	105	4½	4½	106½	—	4 4 6
Lond. Passenger Transport							
A	114½	103	4½	4½	109½	−2	4 2 2
B	117½	102	5	5	105½	−3	4 14 9
C	83½	64½	1½	—	43½	−1	—
West Midland Joint Elec.,							
1948–68	112½	104½	5	5	106½	—	4 14 0
Telegraph and Telephone							
American Tel. & Tel. ...	210	159	9	9	212½xd.	+1½	4 4 8
Anglo-Am. Tel. :							
Pref.	101½	82	6	6	99½	—	6 0 10
Def.	23⅜	17	1½	1½	23	—	6 10 4
Anglo-Portuguese	24/-	16/6	8	8	22/6	—	7 2 3
Cable & Wireless :							
5½% Pref.	97	75	4½	5½	97½	—	5 12 8
Ord.	57½	35	4	4	61½	—	6 10 0
Income	100	85½	—	—	99½	—	4 0 5
Canadian Marconi $1 ...	6/-	3/9	Nil	4cts.	5/6	—	—
Globe Tel. & Tel. :							
Ord.	32/3	22/6	7½*	7½*	31/3	—	4 16 0
Pref.	26/9	20/-	6	6	27/6	—	4 7 5
Great Northern Tel. (£10)...	38	18	20	20	19½	—	10 5 4
Inter. Tel. & Tel.	10½	5	Nil	Nil	5	—	—
Marconi-Marine	30/-	23/-	7½	10	28/9	−⅛	6 19 4
Oriental Telephone Ord. ...	2½	42/6	12*	12*	2⅜	—	4 7 5
Telephone Props.	14/-	12/9	5	6	13/9	—	8 14 6
Telephone Rentals (5/-) ...	10/-	6/3	10	10	8/9	—	5 14 3
Western Union	40½	19½	2⅜	—	32½	—	—
Traction and Transport							
Anglo-Arg. Trams :							
First Pref. (£5)	7/6	3/6	Nil	Nil	4/-	—	—
4% Inc.	16	5	Nil	Nil	11½	+2½	—
British Electric Traction :							
Def. Ord.	950	500	5	5	750	−50	—
Pref. Ord.	164	115	8	8	165	—	4 17 0
Bristol Trams	52/6	35/-	10	8*	48/3	—	3 6 6
Brazil Traction	13	6½	$1	50c.	10½	−½	—
Calcutta Trams	25/6	20/9	8	8	23/6	—	6 16 2
Cape Elec. Trams	18/-	16/9	5	5	17/-	—	5 17 8
Lancs Transport	37/9	27/6	10	10	35/-	—	5 14 8
Mexican Light :							
1st Bonds	35	20	5	5	30½	—	—
Rio 5% Bonds	82	47	5	5	85	—	5 17 8
Southern Rly. :							
5% Prefd.	75½	48	5	5	71	−2½	7 0 10
5% Pref....	99½	79	5	5	100½	−2	4 19 6
T. Tilling	2½	32/6	10	10	43/3	−6d.	4 12 4
Tilling & B.A.	54/6	43/9	9*	8*	47/6	—	3 7 10
West Riding	37/9	30/-	10	10	34/6	—	5 16 8
Equipment and Manufacturing							
Aron Electricity Ord. ...	32/3	17/6	15	15	17/6	—	—
Assoc. Elec. :							
Ord.	45/3	30/-	10	10	42/0	−6d.	4 15 3
Pref.	36/6	30/-	8	8	35/-	—	4 11 5
Automatic Telephone & El.	48/9	37/-	10	12½	47/0	−6d.	5 6 5
Babcock & Wilcox ...	48/-	37/-	10	12½	47/6	—	5 5 2
British Aluminium Ord. ...	61/3	48/-	12½	12½	52/6xd.	−1/-	4 15 3
British Insulated Ord. ...	88/-	70/3	20	20	87/6xd.	−⅛	4 11 4
British Thermostat (5/-) ...	16/-	11/6	18½	18½	14/6	−6d.	6 7 7
British Vacuum Cleaner (5/-)	22/6	8/-	40	12½	12/6	—	5 0 0
Brush Ord....	5/9	2/6	Nil	Nil	4/6	—	—
Callender's	92/-	50/-	20	15	67/6	—	4 9 0
Chloride Elec. Storage ...	82/-	62/-	20	15	3½	—	4 5 9
Consolidated Signal ...	96/-	60/-	36½	17	3½	—	5 4 7
Crabtree (10/-)	25/6	16/6	17½	17½	23/9	−9d.	7 7 4
Crompton Parkinson :							
Ord. (5/-)	21/-	12/6	15	20	18/9	−⅛	5 6 8
E. K. Cole (5/-)	9/-	2/6	10	Nil	3/6	—	—
Elec. & Musical Industries							
(10/-)	14/9	6/6	5	Nil	8/9	−6d.	—
Electric Construction ...	40/6	28/-	12½	13½	36/3	—	7 8 4
Enfield Cable Ord. ...	58/-	37/6	25	16½	53/9xd.	—	6 0 10
Electrical Switchgear (10/-)	27/-	23/-	16	10	21/3	—	4 14 3
English Electric	36/6	25/-	10	10	33/3	—	6 1 0
Ensign Lamps (5/-) ...	16/9	13/9	25	25	15/-	—	8 6 8
Ericsson Tel. (5/-) ...	43/-	32/3	25*	5*	37/6xd.	+1/-	3 6 8
Ever Ready (5/-)	26/6	16/9	35	30	27/6	—	5 19 2
Falk Stadelmann	27/-	18/-	10	6	17/6	—	6 17 4
Ferranti Pref.	25/6	21/-	7	7	23/9	—	5 18 0
G.E.C. :							
Pref.	32/9	25/-		6½	32/6	—	4 0 0
Ord.	82/-	61/-	17½	20	82/0	−6d.	4 17 7
Greenwood & Batley ...	29/-	20/-	7	15	25/-	—	12 0 0
Hall Telephone (10/-) ...	22/3	7/-	15	15	18/9	—	8 0 0
Henley's (5/-)	21/-	13/9	20	20	20/9	—	4 18 1
4½% Pref.	23/-	18/-	4½	4½	20/-	—	4 10 0
Hopkinsons	46/9	37/-	12½	15	46/3	—	6 9 10
India-Rubber Pref. ...	22/-	17/9	5½	5½	20/-	—	5 10 0
Intl. Combustion	121/3	97/-	32½	32½	5⅞	—	5 10 6
J. Lucas	61/-	42/6	15	15	58/9	−⅛	5 2 5
Johnson & Phillips ...	42/6	32/-	12½	12½	47/6	—	5 5 1
Lancashire Dynamo ...	72/-	50/-	25	20	55/-xd.	−⅛	7 5 6
Laurence Scott (5/-) ...	12/-	8/6	15	15	10/-	—	7 10 0
London Elec. Wire ...	31/6	25/-	12	7½	25/-	—	6 0 0
Mather & Platt	50/3	37/6	13½	10	40/9	—	4 18 1
Metropolitan Elec. Cable Pf.	21/3	21/-	5½	5½	21/3	—	5 3 6
Murex	85/9	63/9	20	20	82/6	−⅛	4 16 10
Pye Deferred (5/-) ...	11/6	7/-	25	25	7/6	—	16 13 4
Revo (10/-)	35/6	22/-	17½	17½	20/0	−½	8 15 0
Reyrolle	61/-	52/-	12½	12½	60/-	—	4 3 4
Siemens Ord.	26/9	17/-	7½	7½	23/9	—	6 6 4
Strand Elec. (5/-) ...	5/6	1/3	10	4	2/-	—	8 0 0
S. Smith (1/-)	9/6	5/6	37½	50	7/6	—	6 13 4
Switchgear & Cowans (5/-)	15/-	9/6	20	10	8/9	−½	5 14 3
Telegraph Condenser (10/-)	7/6	5/-	5	—	8/9	—	—
Telegraph Construction ...	2½	27/6	10	10	41/3	—	4 17 0
Telephone Mfg. (5/-) ...	10/-	7/-	9	9	8/6	—	5 2 10
Tube Investments... ...	91/6	68/-	23½	23½	94/6	−6d.	5 1 6
Vactric (5/-)	4/3	2/-	4	Nil	3/-	+6d.	—
Vickers (10/-)	24/6	14/6	10	10	19/-xd.	−9d.	5 5 3
Ward & Goldstone (5/-) ...	22/6	19/6	20	20	19/9	—	5 1 3
Westinghouse Brake ...	54/9	38/-	17½	10	43/9	—	4 11 5
Walsall Conduits (4/-) ...	31/9	21/3	55	55	26/3	—	8 7 8
West, Allen (5/-)	7/6	5/-	7½	10	7/-	—	7 2 10

* Dividends are paid free of Income Tax.

CONTRACT INFORMATION

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), Great George Street, London, S.W.1.

Argentina.—April 17th. State Oilfields Department. Electric crane with a maximum loading capacity of 10,000 kilos. (T. 17018/40.)

Australia.—BRISBANE.—April 16th. City Electric Light Co. 44-, 33- and 11-kV metal-clad switchgear. (T. 16129/40.)*

MELBOURNE.—April 30th. State Electricity Commission of Victoria. Two 66-kV transformers and one voltage and phase angle regulating equipment. (T.Y. 16494/40.)*

April 23rd. Posts and Telegraphs Department. Telephone testing equipment. (T. 16438/40.)*

Edmonton.—April 8th. Corporation. Electrical installation at the central depôt, Montague Road, N.9. E. J. Willis, borough engineer, Town Hall.

Egypt.—ALEXANDRIA.—May 1st. Ports and Lighthouses Administration. Winch, with electric motor. (T. 16729/40.)*

Eire. — ROSCOMMON. — March 29th. County Board of Health and Public Assistance. Pumps, motors, and float controlled automatic stopping and starting gear. J. Kilmartin, Board of Health Office (deposit £2 2s.).

Hastings.—April 8th. Electricity Department. March 15th. Two 200-kVA transformers.

India.—NEW DELHI.—April 4th. Stores Department. Wall plugs and ceiling roses. (T. 16398/40.)*

April 9th. One 1,500-kVA, 3.3/11-33-kV power transformer and arc suppression coil for Bezwada scheme. Specification E.132 (Rs.10) from the Executive Engineer, Electrical and Mechanical Division, Chepauk.

London. — COMMISSIONERS OF H.M. WORKS.—March 29th. Three large electrical installations in the West of England. (March 8th.)

Manchester.—April 3rd. Electricity Department. Twelve months' supplies of electric lamps. H. C. Lamb, chief engineer and manager, Electricity Department, Town Hall.

New Zealand. — WELLINGTON.—Public Works Department. May 14th. Control and relay panels. (T. 16070/40.)*

May 21st. Control and relay panels. (T. 16069/40.)*

May 21st. Public Works and Tenders Committee. Control and relay panels for Mt. Roskill substation, Auckland. (T. 16068/40.)*

April 24th. General Post Office. Telephone parts, bell covers, &c. (T. 17170/40.)*

April 27th. Secondary cells. (T. 17177/40.)*

Rhyl.—April 2nd. Electricity Department. Joint boxes and meters for one year. (See this issue.)

South Africa. — JOHANNESBURG.—April 10th. City Municipal Council. 1,600 sets of insulated type house service cut-outs and 288 spare fuses. (T. 16812/40.)*

April 22nd. Railways and Harbours Administration. 15-ton electrically driven Goliath crane. (T. 16786/40.)*

Insulated wire, flexible cable and cab-tyre flex. (T. 16813/40.)*

PORT ELIZABETH.—April 25th. Municipality. Four 4,000-kVA, three-phase transformers. (T.Y. 16809/40.)*

Straits Settlements.—SINGAPORE.—May 27th. Municipal Water Department. Electrically driven main supply and wash water pumping sets. (T.Y. 16797/40.)*

Walsall.—March 28th. Electricity Department. Eight 400-kVA and one 500-kVA transformers. (March 8th.)

West Midlands. — J.E.A. April 5th. Supply, delivery and erection of 33-kV switchgear and 33/11-kV step-down transformers. (March 15th.)

Weymouth and Melcombe Regis.—April 2nd. Electricity Department. Transformers. (March 15th.)

Orders Placed

Australia.—COMMONWEALTH. — Department of the Interior. Accepted. Standby generating sets (£28,974).—Ruston & Hornsby (Aust.) Pty., Ltd.

VICTORIA.—State Electricity Commission. Accepted. Copper conductors, jointing sleeves and trolley wire.—B.I. Cables.

Brighton.—Corporation. Accepted. Two steam-raising units at Southwick power station.—Babcock & Wilcox. Pumps for Southwick power station.—Gwynnes Pumps.

Croydon.—Town Council. Accepted. Supply of transformers during the ensuing year.—Lindley Thompson Transformer & Service Co. Extra-high-voltage switchgear.—A. Reyrolle & Co.

Glasgow.—Transport Committee. Accepted. Air compressors.—Maley & Taunton (£3,000); E.M.B. Co. (£3,250). Repairs and replacements on the 10,000-kW turbo-alternator set at Pinkston power station (£5,284).—Met.-Vick. Electrical Co.

Hucknall.—U.D.C. Accepted. Electrically driven turbine type pumping set, with a capacity of 30,000 gal. per hour, at the Salterford pumping station (£2,061).—Mather & Platt.

Kettering. — Borough Council. Accepted. Oil-immersed 50-cycle three-phase transformers.—Brush Electrical Engineering Co.; Hackbridge Electric Construction Co.; British Electric Transformer Co.

London.—Metropolitan Water Board. Recommended. Fire alarm system at the Laboratories (£208).—Colston Electrical Co. Replacement of steam plant by electricity at Battersea workshops: Four 15-HP and five 5-HP motors, with starters and equipment (£470).—Bruce, Peebles & Co. Electrical work in connection with change from DC to AC and from steam to motor drive (£1,150).—Colston Electrical Co.

March. — Town Council. Accepted. Traffic signals at Broad Street (£736).—Automatic Telephone & Electric Co.

Swansea.—Electricity Committee. Accepted for twelve months: Cable.—Aberdare Cables; Callender's. Meters and demand indicators.—Aron Electricity Meter; Met.-Vick. Electl. Co.; P. & B. Engineering Co.; Siemens Electric Lamps & Supplies. Extra-high-voltage substation switchgear. — Ferguson, Pailin; G.E.C.; Met.-Vick. Electl. Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—New chemistry department at University; Dr. H. S. Melville, chemistry professor.

Ashington.—Auxiliary fire station, North Seaton Road, for the U.D.C.; J. T. Fletcher, builder, Ashington.

Barnsley.—Mission church, Kendray; Sheffield Diocesan Committee for Church Extensions.

Bebington.—Police station, Moreton; borough engineer, Town Hall.

Birmingham.—Erection of factory premises in Bridge Street West; W. J. Whittall & Sons, builders, Lancaster Street, Birmingham.

New factory buildings in Bath Street; J. R. Deacon, builders, Lichfield.

Reconstruction of hotel premises in Bracebridge Street, for Ansells Brewery, Ltd., Aston; W. C. Skinner, Ltd., builders, Birchfield Road, Birmingham.

Rebuilding the Cobden Hotel, Cherry Street; Jas. Moffat & Sons, builders, Camden Street, Birmingham.

Factory additions in Coleshill Street, Ashted; W. J. Whittall & Sons, as above.

Additions to the buildings of Booth & Sons, Kitts Green Road, Lea Hall; C. Bryant & Sons, builders, Whitmore Road, Birmingham.

New Post Office buildings in Coleshill Street; H. Dare & Sons, builders, Ward End, Birmingham.

Blackburn.—Building extensions in Cartmel Street; John Howarth, architect, Victoria Estate Buildings, Cort Street, Blackburn.

Central garage and shelters, Queen's Park Hospital; borough engineer.

Bolsover.—Pithead baths at Thoresby, for the Bolsover Colliery Co.; Architects' Department, Miners' Welfare Central Fund Committee, Romney House, Tufton Street, London, S.W.1.

Bournemouth.—Sanatorium, Linford, enlargement of Municipal College and police headquarters, Madeira Road; borough engineer.

Bristol.—Alterations at Snowdon Road Hospital (£11,150), completion of Southmead Hospital, and disinfector buildings, for T.C.; borough engineer.

Burton Latimer.—Extensions to offices, Weetabix Mills, for Weetabix, Ltd.

Financial Section *(Concluded from Page 356)*

Reports and Dividends—Contd.

Madras Electric Tramways, Ltd., announce that in consequence of the dislocation of traffic caused by the closing of the Stanley Viaduct for repairs, consideration of the payment on the 6 per cent. cumulative preference shares has been postponed until the accounts are available.

Whitehall Electric Investments, Ltd., has decided to pay on April 1st in respect of the 7½ per cent. preference stock the unpaid portion of the dividend for the half-year ended September 30th—¾ per cent.—and the full dividend of 3¾ per cent. for the half-year ending March 31st, 1940.

The Ascot District Gas & Electricity Co. is paying a final dividend of 2½ per cent., making 5 per cent. for the year (same).

W. Canning & Co., Ltd., are maintaining their distribution for 1939 at 20 per cent. by the final payment of 5 per cent., plus a bonus of 10 per cent.

The Midland Electric Corporation for Power Distribution, Ltd., has announced a final dividend of 6 per cent., again making 9 per cent. for the year.

The Canadian General Electric Co. has declared an interim dividend of $2 per share for the quarter to March 31st.

The Quebec Power Co. reports a net income for 1939 of $1,328,704, as compared with $1,253,022 for 1938, and after providing for depreciation, losses of subsidiary and tax, there is a balance of $627,704 (against $640,856). A sum of $93,000 is placed to contingency reserve. The domestic power sales totalled 98,037,538 kWh (against 88,575,682 kWh).

Lancashire Dynamo & Crypto, Ltd., has declared a final dividend of 10 per cent. and a bonus of 5 per cent., making 20 per cent. for the year (against 25 per cent. for 1938).

The Rangoon Electric Tramway & Supply Co. is paying a final dividend of 12 annas per share, free of Burma tax (against Rs.1), making Rs.1 per share for the year (against Rs.1.6).

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Bury (LANCS).—New works and alterations to existing premises, for Spencer & Curedale, Ltd., Bury Grounds, Bury; T. A. Fitton and Sons, architects, 7, Chapel Walks, Manchester.

Cheltenham. — Rebuilding laundry, Churchill Road; Sunshine Laundry, Ltd.

Chester. — Completion of partially erected Frodsham senior mixed school; Moston Brick & Building Co., Ltd., contractors, Kenyon Lane, Moston, Manchester.

Chesterfield.—Greyhound track and stadium; W. Aland, 38, Vance Street, Blackpool.

Chorley.—Conversion of Hartwood House to maternity home, for Chorley and District Hospital governors.

Coventry. — Extensions to Roman Catholic Church, Kingsland Avenue, for Rev. T. L. Hampton; Sandy & Norris, architects, 134, Newport Road, Stafford.

New "Convoy Hotel" at junction of Penny Park Lane and Watery Lane, Keresley, for Mitchells and Butler, Ltd., Capehill Brewery, Smethwick; W. S. Hattrell & Partners, architects, 1, Queens Road, Coventry.

Crewe.—Greyhound track and stadium; W. Aland, 38, Vance Street, Blackpool.

Dudley.—Report centre, Charlotte Street, for T.C.; borough engineer, Town Hall.

Dukinfield.—Day school, Globe Lane; borough engineer.

Dunfermline.—Houses (400), Brucefield; burgh surveyor.

Dunmow.—Filter house at Thaxted Pumping station (annexe), for R.D.C.; Edward Sandeman and Partners, engineers, 15, Victoria Street, Westminster, S.W.1.

East Sussex.—Reconstruction of portion of Darvel Hall Sanatorium, Robertsbridge, for C.C.; county architect, County Hall, Lewes.

Edinburgh.—Brewery extensions, Holyrood Road; William Younger & Co.

Church hall, &c., at Crewe Toll; Church of Scotland General Trustees.

Additions, Lochend Road; Smith and Sons (Hawkhill), Ltd., Leith.

Eire.—DUBLIN.—Houses (62), Emmet Road housing site, for T.C.; H. G. Simms, housing architect, 5, Wellington Quay, Dublin.

RIVERSTOWN.—Dispensary, for Sligo Board of Health; R. J. Kirwan, county engineer, Courthouse, Sligo.

Felling (Co. DURHAM).—Three shelters at Felling School; H. Fawcett, U.D.C. architect.

Gateshead.—Substation, Prest Street, for Northern Rediffusion Services, Ltd., Blackett Street, Newcastle-on-Tyne.

Boiler house and laundry at Sheriff Hill Hospital; F. H. Patterson, borough engineer.

Completion of houses (146) at Highfield, for the Town Council; E. Jeffcock, builder, Split Crow Road, Gateshead.

Transit shed extensions at Hillgate Quay, for Tyne-Tees Shipping Co.; Arthur and Kirkup, architects, 13, Swinburne Street, Gateshead.

Glasgow. — Proposed improvement scheme in Cowcaddens, including new buildings and shops; city architect.

Hamilton.—New offices, canteen and pattern shop, for Fullwood Foundry Co. at Burnbank Road (£2,500); the manager.

Harwich.—Public shelters (200 persons), for T.C.; F. Harold French, borough engineer, King's Quay Street, Harwich.

Hebburn-on-Tyne. — Alterations and improvements to the Argyle Hotel; Hetherington & Wilson, County Chambers, Newcastle.

Horley.—Additions to Horley Cottage Hospital; G. Gordon Stanham.

Hyde.—Extensions to hospital; borough engineer.

Keighley.—Additions, Syke Mill, Oxenhope; Joseph Ogden & Co., Ltd.

Lanchester.—Sewage disposal works; R.D.C. surveyor.

Leeds.—Public shelters (£8,100), for T.C.; city engineer.

Liverpool.—Maintenance depôt, Speke, for Housing Committee; director of housing, Rose Lane School, Mather Avenue, Liverpool, 18.

Proposed schools, Leyfield Road, West Derby, and Island Road, Garston, borough engineer.

Lowestoft.—Factory extension, Thurston Road; W. J. Croft, Ltd.

Manchester.—Pithead baths at the Wheatsheaf Colliery of the Manchester Collieries Co., Ltd., Walkden; Architects' Dept., Miners' Welfare Central Fund Committee, Romney House, Tufton Street, London, S.W.1.

Lock-up shops, Lapwing Lane, West Didsbury; Mrs. W. Goodfellow, 60, Palatine Road, West Didsbury.

Lock-up shops and flats, Stanley Grove, Gorton, Housing Committee.

Methley (YORKS). — Pithead baths, Savile Colliery; Architcts' Department, Miners' Welfare Central Fund Committee, Romney House, Tufton Street, London, S.W.1.

Middlesbrough.—Air-raid shelters at four schools; P. Mellor, education architect.

Dairy extensions for the Middlesbrough Co-operative Society, Clifton Street, Middlesbrough.

Morley.—Canteen and cloakroom, Valley Mills, Drighlington; Booth Bros. (Drighlington), Ltd.

Alterations, Perseverance Mills; A. Marshall and Sons, Ltd.

Canteen, Springfield Mills; Troydale Woollen Co., Ltd.

Newcastle-on-Tyne. — Cold storage, Brinkburn Street, for J. Lowrie and Co.; J. N. Fatkin, architect, 17, Bigg Market, Newcastle-on-Tyne.

Timber works at Sandgate; John Jackson & Sons, Corporation Street, Newcastle.

North Cotswold.—Houses (41), on eleven sites, for R.D.C.; surveyor, Council Offices, Moreton-in-Marsh.

Nuneaton.—Fire station in Newtown Road, including ambulance station (£20,000); R. C. Moon, borough engineer and surveyor, Council House.

Preston.—Completion of new junior school at Farringdon Park for E.C.; J. Cryer & Sons, contractors, Poulton Road, Fleetwood.

Rochdale.—Extensions to central fire station; borough engineer.

Public shelters (7), The Esplanade and Theatre Street; borough engineer, Town Hall.

Rochester.—New police headquarters, for T.C.; city surveyor, Guildhall, Rochester, Kent.

Rushden.—Additions to factory, Allen Road, for P. Collins & Co., Ltd.

Sedgefield.—School shelters at West Cornforth, Trimdon Grange, Broom Cottages and Sedgefield for Durham C.C.; county architect, 34, Old Elvet, Durham.

Sedgley.—Clothing factory, Abbey Road; W. Hill & Co. (Dudley), Ltd.

Sheffield.—Constructional work at Sheffield Cathedral; Sir Charles A. Nicholson, architect, 2, New Square, Lincolns Inn, London, W.C.2.

Houses and shops, for T.T. Osborne, Bradway Grange, Beauchief, Sheffield.

Extensions to works; R. W. Carr & Co., Pluto Works, Owlerton.

New branch libraries at Manor Road and at Ridgefield Road; W. G. Davies, city architect, Town Hall, Sheffield.

New law courts (£74,288), and health laboratory (£9,137); city engineer.

Skipton.—Extensions to tannery for J. Brooksbank, Son & Co.; J. Howard Wales, architect, Exchange Buildings, Liverpool.

Smethwick.—Municipal Bank buildings at High Street, Smethwick; H. Dare & Sons, builders, Ward End, Birmingham.

Stockport.—School, Broadstone Hall Road, for E.C.; borough engineer.

Stoke-on-Trent.—Hotel, High Street, Hanford; B. J. Bellison.

Additions, Longton Cottage Hospital; Wood & Goldstraw, architects, Victoria Road, Tunstall.

Stonebroom (ALFRETON). — Licensed premises, Stonebroom Lane; W. R. Rowland.

Sunderland.—Erection of hutments as school on the Plains Farm estate for the E.C. (£2,000).

Air-raid shelter for M. Davis & Son, cabinet makers, High Street; Matkin & Hawkins, architects, Barclay's Bank Chambers, Fawcett Street, Sunderland.

Canteen at Pallion Shipyard for W. Doxford & Son, builders, Stockton Road, Sunderland.

Swansea. — Rebuilding 268, Oxford Street; E. Jenkins & Co.

Tendring.—Fire stations at Parkeston and Manningtree, for R.D.C.; surveyor, Council Offices.

Totnes.—Mill and offices, Farwell estate; Torbay Mill Co., Paignton.

Wakefield.—Erection of laboratory and loading shed at Calder Vale Road for Brotherton & Co., Ltd., City Chambers, Leeds, 1; Brotherton & Co., Ltd., contractors, City Chambers, Leeds.

Walsall.—Factory, Chase Terrace; E. B. Hamel & Son, Felix Mill, Tamworth.

Wellingborough.—Extensions to factory; Victoria Leather Co., Ltd., Midland Road.

Wellington (SALOP).—Large number of houses off Farm Lane; J. B. Cooper, architect, Coleridge Chambers, Corporation Street, Birmingham.

Wembley.—Extensions to factory; Mining & Chemical Products, Ltd., Ealing Road.

West Hartlepool.—Public shelter, Park Road, for the T.C.; W. W. Brazell, builder, Raeburn Street, West Hartlepool.

West Sussex.—Completion of court house, Chichester (£14,292), for C.C.; county architect, County Hall, Chichester.

Wisbech.—Extensions to factory for Wisbech Produce Canners, Ltd., Lynn Road; H. W. Lindo, architect, 37, Panton Street, London, S.W.1.

Workington.—Erection of factory for the West Cumberland Development Co.; Leslie's (Workington), Ltd., contractors, 55, Washington Street, Workington.

Erection of new works, Drybread site, Marsh Street, for Workington Iron & Steel Co., Ltd., Moss Bay; G. Graham, contractor, William Street, Workington.

York.—Omnibus shelter, York Railway Station, for Corporation; Chas. J. Minter, city engineer, Guildhall.

FORTHCOMING EVENTS

Institution of Electrical Engineers.—Thursday, March 28th. Institution, London, W.C.2. 6 p.m. "The Limitation of Transformer Noise." By B. G. Churcher and A. J. King.

Scottish Centre.—Tuesday, March 26th. Royal Technical College, Glasgow. 6.30 p.m. Informal joint meeting with the Students' Section. Discussion on "Tariffs." To be opened by J. Eccles.

North-Eastern Students' Section.—Friday, March 29th. The Newe House, Newcastle-on-Tyne. 7 p.m. "Radio Relay Services." By H. F. Goodwin.

North Midland Centre. — Saturday, March 30th. Hotel Metropole, Leeds. 2 p.m. "A Critical Survey of American Metering Practice." By G. F. Shotter.

Mersey and North Wales (Liverpool) Centre.—Monday, April 1st. Liverpool Royal Institution. 6.15 p.m. Annual general meeting.

Institution of Electronics.—Thursday, April 4th. Royal Society of Arts, Adelphi, W.C.2. 6 p.m. "Wave Mechanics." By Prof. D. R. Hartree.

Electrical Association for Women.—Institution of Electrical Engineers, London. April 18th, 10.15 a.m. Annual meeting to be followed by an address by Miss C. Haslett, the director, on "The E.A.W. and its Work in Wartime," supplemented by a discussion. 12.45 for 1.0 p.m. Park Lane Hotel, W.1. Annual luncheon. 3 p.m. Inspection of newly planned kitchen at headquarters.

Institution of Engineers-in-Charge.—Friday, April 19th. Holborn Restaurant, London, W.C.2. 6 for 6.30 p.m. Annual dinner.

Junior Institution of Engineers.—Saturday, April 20th. The Monico Restaurant, W.1. Luncheon.